JULY 1937
VOLUME 11
NUMBER 11

# MODERN PLASTICS

E. F. LOUGEE, Editor
C. A. BRESKIN, Publisher
Dr. G. M. KLINE, Technical Editor

## Of General Interest



## Technical Section



## News and Features



## Color Note

Our cover this month is AMAZON BLUE, matched as closely as it is possible to match silk with printer's ink. The Textile Color Card Association says AMAZON BLUE will be one of the popular colors in Fall fabrics for apparel and decoration and the versatile colors of plastic materials should be made available in matching shades. Our cover next month will be ROMAN BRONZE, Sept., CAPRI GREEN.

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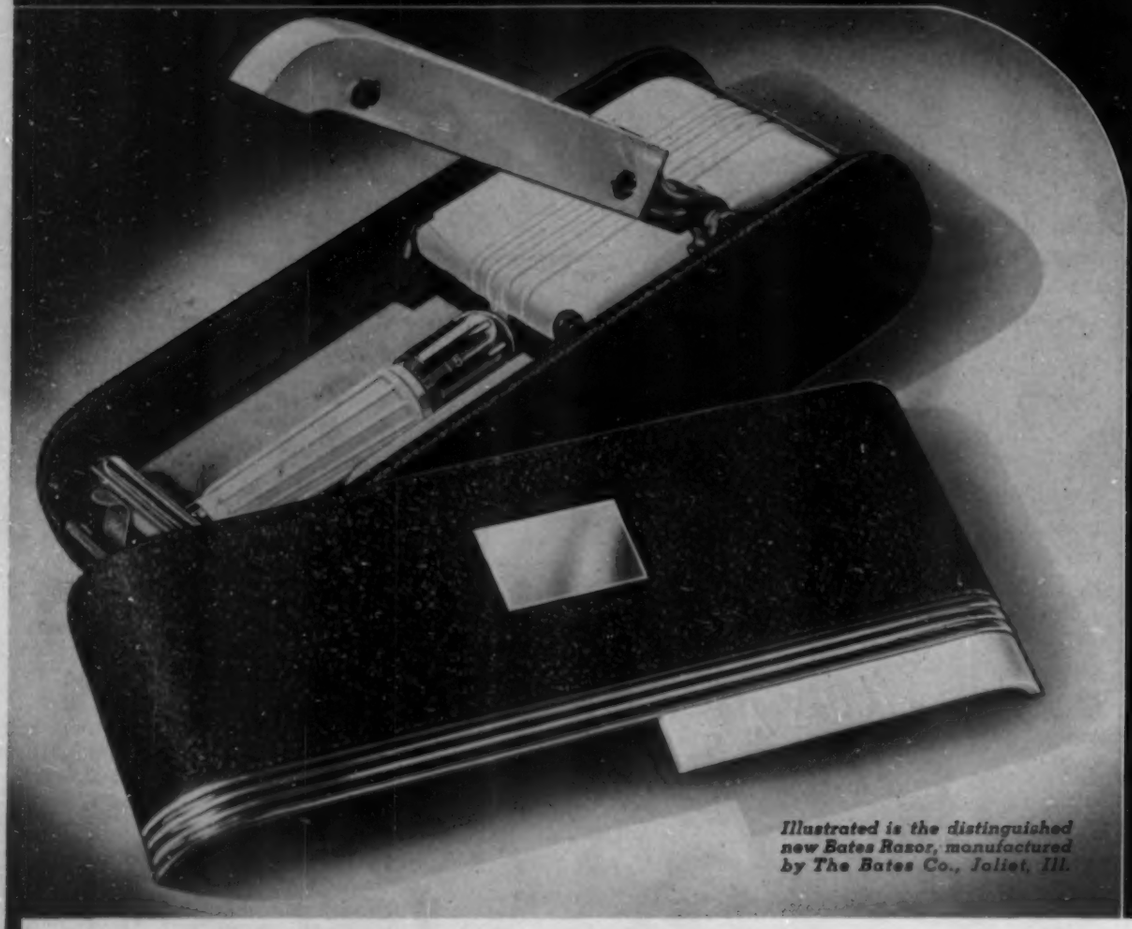

*Illustrated is the distinguished new Bates Razor, manufactured by The Bates Co., Joliet, Ill.*

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MODERN PLASTICS

JULY 1937 VOLUME 14 NUMBER 11

# INDUSTRIAL SAFETY DEVICES

by E. F. LOUGEE

**Based on an interview with Thomas Willson, president of Willson Products Incorporated, whose company for sixty-six years has devoted its efforts to the manufacture of protective goggles and industrial safety appliances. Mr. Willson is also president of the Industrial Safety Equipment Association**

1 Special type goggle with translucent side and heavy duty lenses. Ventilated with fine wire screen

WHEN THE CAVE MAN STARTED TO CHOP HIS house out of rock and during the process mashed his thumb with a stone hammer, or put out one of his eyes with flying shale, it was just too bad, and nobody was much concerned about it except himself. But from that day to this, with the steady advance of civilization and the incidental introduction of huge factories, the development of vast mining enterprises, and the heavy construction essential to their being, there has been an increasing need for protection of workers from occupational dangers until workmen in our modern factories are given the advantage of every known protective device. Unfortunately, this is not true of all industry, but the majority of industrial managers, recognizing the intimate relationship between healthy, contented workmen and continuous production, provide these protective devices and encourage their use.

It is only within the last thirty years, however, that decisive steps have been taken to eliminate unnecessary occupational deaths and injuries. In 1908 T. A. Willson & Co., since changed to Willson Products Inc., one of the first to realize the acute need of protection for workmen at hazardous occupations, pioneered in the production of industrial safety equipment. At that time when an exhaustive study of occupational dangers was begun, the hazards and requirements for guarding against them were less pronounced than they are today. Consequently, the first protective devices developed were far different from present day safety appliances and not nearly as adequate, but continuous probing for methods of improvement and constant study of new manufacturing processes and accompanying dangers to those who operate them, have resulted in a high degree of efficient protection. This one company alone now makes more than 300 styles of protective equipment for head, eyes and lungs of workmen and each is designed to do a particular job.

The importance of industrial safety measures was emphasized in 1913 when the appalling number of accidents in industry brought about the intervention of the National Safety Council, and a real effort was made to reduce them. Naturally compensation insurance companies were vitally interested and contributed to the movement because the amount of money required to pay compensation in accident cases was rapidly mounting with resulting dissipation of funds. Unrelenting insistence upon safety measures for workmen by these two agencies could not be ignored and their efforts slowly but surely bore fruit. First aid facilities were introduced to care for minor injuries on the spot and to prevent in-

~ ARC WELDING HELMET OF FIBER WITH DOUBLE LENSES SET IN "FLIP UP" PLASTIC FRAMES

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Welding goggles with double lenses in "flip up" plastic frames. Closed (Fig. 3), the workman is protected from the infra red rays of the welding arc; open (Fig. 4), he has clear glass to inspect and finish the welding operation. Hinged frames (Fig. 5) are of plastic material

fection. Machinery was guarded to prevent factory accidents and many other preventatives were planned and put into operation in many manufacturing fields.

Perhaps the greatest obstacle in the path of complete safety, has been found to be the workman himself. With all the aids available for his use, it is exceedingly difficult to get him to utilize them for his own protection. As a simple example, he may fully realize that his eyes are his greatest asset and that a one-eyed man cannot possibly be as efficient or earn as good a livelihood as a man with two eyes, yet sometimes unless stringent measures are adopted to induce him to wear protective goggles, he will frequently be found performing dangerous occupations without them. To combat this condition, some companies operate a bonus system whereby foremen and operators are divided into teams or groups which win merits and often monetary compensation by eliminating or reducing possible accidents in connection with their work. When accidents do occur under this arrangement, the workman causing it, or suffering it, is not only injured physically but he is also in disfavor with his entire team.

To determine the results of industrial safety appliances measured in terms of reduced accidents is not easy. Like fire prevention or any other intangible effort which is definitely worth while, its benefits are hard to measure with any degree of accuracy. Quoting from *Accident Facts*, 1936 Edition, published by the National Safety Council, Inc.: "Various authorities have estimated that about 35,000 occupational accidental deaths occurred in 1913; the 1935 total was only about 16,500. Although year-by-year estimates cannot be made with any accuracy until 1928, it is reasonable to believe that a gradual decline began in 1913, with the practical beginning of organized accident prevention work in industry; and that this decline continued, undoubtedly with some ups and downs until 1928, when a thorough study of available data indicates an estimated total of 19,000 deaths arising out of gainful employment accidents. For the years following 1928 annual estimates have been made, the low figure being reached in 1933 at 14,500 fatal work accidents.

"The cumulative effect of these gradual reductions is that there have been approximately 250,000 fewer deaths and 25,000,000 fewer disabling injuries than would have occurred had each year witnessed as many industrial accidents as occurred in 1913. The estimates of accidental deaths in gainful employment that actually did occur during the twenty-three years total to 550,000. However, had 35,000 deaths occurred in each year, as did occur in 1913, the total would have been about 800,000. This calculation takes no account of an increasing number of gainfully employed persons exposed to occupational dangers. With such an increase in exposure an increase in fatalities might have been expected, instead of the decrease which did occur."

Judging from these estimates, it is safe to say that industrial accidents are definitely on the decrease as compared with years ago and a good part of it is generally attributed to the protection which has been provided and which was not available before.

Items of industrial safety embrace helmets and hand shields with special lenses for welding and heavy grinding operations, which are used by nearly all industries such as railroads, iron and steel works, automotive industry, farm implement manufacturers, foundries, quarries, mines, smelters, building trades; in fact, there is need for them in any work where there is a possibility of flying particles, injurious glare, or dust. There are respirators for protection from smoke, flame, chemical fumes and all other possible dangers to lungs, not to mention the millions of gas masks being made for the protection of fighters and civilians in the event of war.

Other equipment for the protection of workmen in-

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clude safety hats and helmets to prevent skull injuries caused by any object falling from a distance and these are indispensable in mines where falling rock is a constant menace; there are shields to protect a worker's skin as well as his eyes from injurious light rays; and there are all sorts of protective covering for arms, fingers, hands and legs as well as metal shoes to guard against crushed feet, and pads for the stomach to prevent injury from flying wood thrown from a saw.

The first industrial safety device was, naturally enough, for the eyes and goggles, of course, constitute a major item of safety in many fields of hazardous endeavor. But goggles that give perfect protection to workers in one field are often of no value whatever to workers in another. Therefore, special goggles must be designed and manufactured for each type of occupation. For example: A man working on a locomotive and a man working in a mine both need protection from the same sort of hazards. The man on the locomotive needs protection from flying particles but he has natural ventilation which helps keep the lenses from fogging, while the miner working underground has a minimum of ventilation and yet his goggles must be planned to give him the same sort of service and protection. This means that these two workers must have entirely different goggles for the same purpose.

The earliest eye protecting device to be introduced was a spectacle type goggle which was used principally by men engaged in grinding and chipping stone for the building trades and in making tomb stones where design and lettering required close application of the eyes. Unfortunately, the glass broke easily, but the success of that goggle in guarding eyes from fine dust led safety-minded people to develop spectacle type goggles with a thicker lens, but even these were too readily broken. To overcome this difficulty, Willson Products Inc., developed a special heat-treating process for the hardening of glass which greatly reduced lens breakage.

The preparation of suitable frames became the next objective since the spectacle type goggle was not entirely satisfactory because its frame was not sufficiently strong in construction, nor did it afford side protection for the workmen's eyes. A light weight metal goggle, made mostly of aluminum appeared nearly twenty years ago and gained its greatest run of popularity after about five years. It was called a "cup type" goggle, and while this type has persisted and is still in general use, early examples proved inadequate except for certain operations where side light was not required. Pieces of metal at each side extending from the lens to the face afforded complete side protection but acted somewhat in the nature of blinders preventing the workman from seeing

An eye is worth saving. Once lost, the workman is forever handicapped in earning his daily bread. These eye-cup goggles (Fig. 6) protected this workman from a splash of hot lead incurred by a babbitting operation, which may be seen still covering the right lens. Flying sparks from grinding operations constitute a hazard (Fig. 7), as does the welding operation (Fig. 8) which goggles overcome

in any direction but straight ahead. Then, too, the goggle was light in construction and because of this the frames were easily broken and bent in continuous use.

Safety engineers determined to afford better protection, cooperated with manufacturers of protective equipment and produced a goggle of fiber of the same cup type. This also fell short of perfection because of the tendency of the fiber to absorb moisture and become soft, losing shape as well as much of its protective value. Further search for proper material led to experiments with molded plastics for cup type goggles but these attempts were at first discouraging because of the brittleness of the plastic used. When canvas content was included in the plastic material to give it strength, that too, was inclined to absorb moisture but to a much less degree than the fiber it succeeded.

Goggle manufacturers at this point took their troubles directly to manufacturers of plastic materials and were able to secure a composition which was tougher, and in which it was seldom necessary to incorporate a canvas filler. Where macerated canvas is considered essential to give the molded part exceptional impact strength, recent methods in producing this material have overcome any tendency to absorb moisture and under no conditions will the plastic become soft. Within the last five years the value of plastic cup type goggles has been ably demonstrated and the success of phenolic opaques has encouraged the use of translucent acetates which workers like and are more willing to wear. While the construction is heavy, the material is light in weight and men do not feel that they are wearing blinders. Sufficient side light is admitted to make them comfortable in use and the side vision they permit protects the workman from being hit by moving cranes or other apparatus which he could not see approaching with opaque side shields.

The use of plastics permits the manufacturer to shape the goggles anatomically to the wearer's face which adds to comfort in use. This translucent cup type goggle is considered the most efficient yet devised and is favored by leading safety engineers as the best possible protection for eyes. Translucent cover-all goggles may be worn over ordinary glasses for vision correction and are suitable to all occupations where intense heat is not directly encountered while they are being worn.

Through the incorporation of an aluminum ring in the lens frame, acetate goggles will stand much greater heat than would otherwise be possible. The strengthening character of the metal makes the frames more rigid and prevents natural expansion and contraction of the plastic material under varying temperatures. The acetate is exceedingly tough and resilient and may be fashioned either by injection or compression molding methods. Threads and inserts (*Continued on page 59*)

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Acid fumes in a chemical plant (Fig. 9), call for both goggles and respirators if workmen are to endure without endangering their health. Respirators provided with a chemical cartridge (Fig. 10) are used for fumes and smoke operations. Goggles and respirator protect this workman (Fig. 11) while dressing a grinding wheel

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RAYMOND LOEWY

# DESIGNER AT WORK AND AT HOME

Raymond Loewy, who needs no further introduction to our readers, has used laminated plastic materials in the design of his office and living room furniture in his penthouse workshop and apartment atop the building at 580 Fifth Avenue, New York City.

Being an engineer as well as a designer, he has employed these materials where their lasting qualities and clean, smart appearance prove to be of the greatest functional value. His personal desk, shown in figure 4, and his working desk, in figure 3, have plastic tops which cannot scratch, dent, chip, absorb ink, or be damaged by cigaret burns. The specially designed console, figure 5, and concealed bar, figure 1, in Mr. Loewy's living apartment are topped with off-white Formica.

Figure 2 shows the mantel and fireplace ensemble as well as the ingenious indirect lighting fixtures which are so designed as to become integral with the walls.

In contrast, Mr. Loewy recently purchased one of the oldest houses on Long Island which he is furnishing with antiques.

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Experts preparing moulage material and smoothing wax specimens of crime evidence. Technical Laboratory, Federal Bureau of Investigation, U. S. Department of Justice

# MOULAGE AT THE FEDERAL BUREAU OF INVESTIGATION

by E. F. LOUGEE

**Our editorial mail contains many requests for information on a plastic material which can be "poured" into a mold to harden without pressure or heat. Moulage, a scientifically developed plastic material available commercially, may be an interesting answer to these inquiries**

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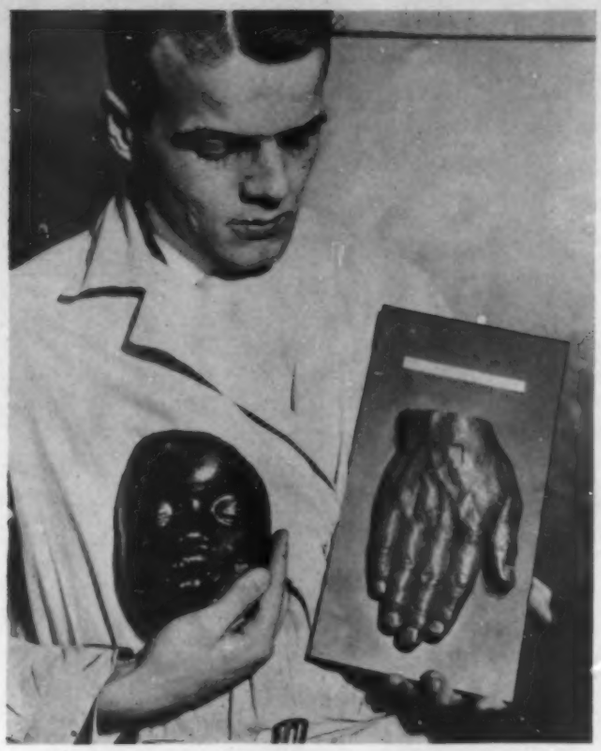
IN THE FEDERAL BUREAU OF INVESTIGATION, moulage constitutes an important link in the solution of crime; the reproduction of original evidence. It is frequently the means of establishing definite identification of criminals on the loose. It often supplies and perpetuates invaluable records of a crime, as well as of the criminal and his weapons. Death masks are no mere incidental examples of the sculptor's art; they are essential to scientific measurements and data in establishing evidence upon which criminals may be convicted. And they facilitate identification of unknown dead.

Through the courtesy of J. Edgar Hoover, Director of the Bureau, the writer was permitted to visit the Technical Laboratory recently and watch the fascinating process in everyday operation.

What is moulage? Well, it really isn't a member of the group of plastic materials usually presented in this publication, yet the association is relative. Moulage is a word of French origin (*mouler*) meaning to cast, or mold. And plastics (from the Greek, *plastikos*) means fit to mold. So in their genesis the two are inseparable and in common practice, moulage has come to mean both the materials used and the methods by which they are employed in this particular process. They will be described later.

A logical query to the phrase "Reproduction of Original Evidence" (1) might well be—why seek to obtain a reproduction which is actually of less value as evidence than that which is already existent. The answer is perhaps best illustrated by a hypothetical situation—one which the law enforcement officer must be prepared to



Moulage casts made in connection with a criminal investigation at the Technical Laboratory, Federal Bureau of Investigation, U. S. Department of Justice

cope with: An officer, arriving at the scene of a crime, finds a body from which all immediate traces of identification have been removed, even to the severing of hands to prevent identification through the medium of fingerprints. He also finds nearby, footprints impressed in the earth which because of their varying size, shape and location, show evidence of the presence of two persons who have been engaged in a struggle. Several of these prints are clearly outlined. In addition, an automobile tire track is found imprinted in the ground nearby; no other information of value is available after the most minute examination has been made. The foot and tire imprints are definite clues, yet by their very nature they are fragile things which rainfall might erase or careless persons obliterate before a suspect's shoes or an automobile tire are available for comparison. The facial features of the victim, of course, constitute a means of identification, but sometimes only after countless individuals have viewed them. Obviously, something must be done at once to preserve this evidence. The answer is to translate this valuable information into three-dimensional replicas through the medium of plaster of Paris or this process of moulage.

To illustrate, you will see in the foreground of the photograph on the opposite page, showing Federal Experts in the Technical Laboratory of the Bureau in Washington, the death mask of John Dillinger. It was made in the Chicago Morgue immediately after he was shot.

Another death mask, illustrated, is that of the face of a little negro girl whose body was found in a sewer not long ago. She had probably been dead about ten days and identification was at first difficult. A glaring wound on her forehead indicated she had been murdered. Killed by a blow from some blunt, heavy instrument at the time unknown. The head was badly decomposed and portions of her face had been attacked by sewer rats. The Bureau made several reproductions of this mask by the moulage process, coloring them to look as life-like as possible. Officers showed them to children coming from school in the neighborhood where the body was found. They would ask, "Do you know whose picture this is?" After three days their search ended. Someone identified the child and told where she had lived. At her mother's home a stove poker was found which exactly fitted the wound on the child's forehead. Confronted with this fact, the mother confessed and was convicted of murder on the evidence secured.

Moulage, originally drafted from the fields of art and medicine to meet the special needs of crime detection and identification work, shows a gradual improvement over a period of years, of the materials used to effect the desired reproduction. The first objective of the law enforcement officer upon arrival at the scene of a crime, is to obtain a mold which is a negative copy of the object to be reproduced; the second is to make a positive cast or actual reproduction of the object in question using the mold as a medium for obtaining it. In other words, the positive material is poured into the negative mold to secure the finished reproduction which is termed the cast.

Before moulage came along, various methods were employed, and materials such as wax, glue, cement, fat, suet, clay and others were used within the limit of their ability. Plaster of Paris, too, plays an important part in the gathering of such evidence. Glue and gelatin have been used for molding purposes with fair success and due to their elastic properties it is possible to cast in one piece, objects with numerous (*Continued on page 63*)

Moulage casts of three fingers and a thumb. Technical Laboratory, Federal Bureau of Investigation, U. S. Department of Justice

# WITHOUT ARTIFICIAL RESPIRATION

(EDITORIAL COMMENT)

THE VERY ACTION OF THIS PLASTICS INDUSTRY makes it exciting and its rapid growth from year to year is exceedingly interesting to watch. Patents complicate some of the steps of progress but nevertheless, the industry is striding along at a phenomenal pace. And beneath it all—behind the scenes—chemists and technicians are quietly at work in laboratories and shops evolving new formulas, improving old ones, creating and building new machines to keep up with the advance.

Gathering production data on plastic materials is not easy. Privately owned companies like to keep their figures to themselves and no one can blame them. Figures from the few corporations which make them available are not enough to make the estimate complete. This has complicated the task of the U. S. Tariff Commission which set out two years ago to gather and assemble these figures on a yearly basis. A small staff, visiting practically every important plant in the country has, however, gathered sufficient information to present the picture of plastics production in a fairly clear way and a partial result of their efforts for the year 1936 is abstracted on pages 39 and 40 of this issue.

SYNTHETIC RESINS OF COAL-TAR ORIGIN MADE a gain of about 33 percent over 1935, but when compared with available figures averaged for the period 1927–30, they show a gain of nearly 500 percent. Non-coal-tar resins, it will be seen, jumped from a little over 4 million pounds in 1935 to nearly 15 million pounds in 1936, a gain of about 375 percent. Since this group includes the newer acrylate and methyl methacrylate resins which have just entered the production stage, these figures will be interesting to watch this year.

Casein, large quantities of which are consumed by the button industry, is advancing again in production. Prior to 1929, about half this country's requirements were imported. Since then, imports have been falling off along with total consumption. In 1935 nearly 4 million pounds of casein plastics were produced. Increased production and facility of fabrication have advanced the use of casein plastics considerably during the past year.

CELLULOSE ACETATE FIGURES SHOW A GREATER gain than those for cellulose nitrate which indicates that the reduction of fire hazards through the use of acetate material is considered to be worth the additional cost. The gain in production of sheets, rods and tubes of cellulose acetate is about 30 percent, but it must be noted that these figures do not include the cellulose acetate molding compounds which have enjoyed tremendous growth during the past year through the progress made with injection molding machines and equipment. No dependable figures have reached us, but from the quantities consumed in the automotive field, for steering wheels, handles, knobs, ash trays and covers, cigaret lighters, and instrument panel equipment; and in radio knobs, dials and bezels; the increase in this type of thermoplastics must equal if not exceed the advances recorded by the thermosetting group.

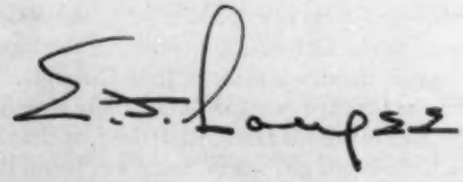
In appraising these figures and attempting to chart their predictions, it is well to remember that since the beginning of the present year, the number of injection molding presses in use in this country has nearly doubled. If all these presses should run to capacity, figuring a 4-oz. charge for each injection, they would consume nearly a million pounds each eight-hour shift, or about 300 million pounds a year for each eight-hour shift. This method of molding, however, is limited at the present time to thermoplastic materials (those which can be remolded by heat).

SOME PEOPLE GET VERY EXCITED ABOUT injection molding and rush in to ask if we think it will eventually replace all other methods of plastic fabrication. They do not seem to comprehend that each type of plastic material has a field of application all its own and that there is little likelihood of any one plastic material, or any one method of fabrication, supplanting all others. Improvements may come which will give one group of materials certain advantages over others, but present indications are that there is room for each in its field. Each has a definite job to do.

One thing is certain, however, injection presses are being rapidly improved, capacities increased and greater quantities of thermoplastic materials consumed.

Also, methods and techniques for molding thermosetting materials are being rapidly advanced. Automatic and semi-automatic presses will handle this type of material with speed comparable to injection molding, especially small parts which can be quickly cured, and the price advantage of thermosetting compounds together with their ability to withstand heat after they have been molded, assure their permanent status.

PERHAPS THE MOST ENCOURAGING ASPECT OF the advance made by the plastics industry is that it has been steady and consistent over a period of years. It has enjoyed a natural and healthy growth based squarely upon consumer demand. It cannot be considered a child of the depression, nor has it required any artificial respiration during recovery.



# IF WE WERE GIVING MEDALS. . .
# WE'D PIN ONE ON. . .

G. VICTOR SAMMET

THOMAS H. CABLE

**G. Victor Sammet, president of the Northern Industrial Chemical Company, because with an education obtained at Massachusetts Institute of Technology, a Ph.D. Degree from the University of Leipsic, and a short training with Merrimac Chemical Company, he entered into the manufacture of oil soluble dyestuff in 1907 and through experimentation two years later, developed one of the first heat resisting plastic compounds called Roxite; because this started the company in the molding business which has since superseded all other interests; and finally, because he enjoys golf, is an ardent fisherman, and disappears on the slightest pretense to a camp he has hidden away "Down in Maine."**

**Thomas H. Cable, because after attending the University of Kansas, in the Sunflower State, he sought additional education in the U. S. Naval Academy where he graduated in 1930 and was assigned to a graduate course which he completed in 1931; because his work in the Marine Sales Department of the Westinghouse Electric and Manufacturing Company during the next seven months led him to the advertising department of that company; because, in January 1935, he was assigned exclusively to planning and preparing industrial products advertising which includes the Micarta account; and finally, because in January 1936, he became a Division Manager in the Advertising Department.**

LOUIS MANSFIELD ROSSI

**Louis Mansfield Rossi, because almost from the time he graduated from Columbia College School of Mines his fondness for chemistry has gradually led him through the National Fireproofing Company, Roessler & Hasslacher Chemical Company, the Formaldehyde Plant of the R & H Chemical Company, and finally in 1910 to works manager of the General Bakelite Company; because under him, operations expanded until a handful of men became an organization which several times outgrew its accommodations; because upon consolidation of the General Bakelite Co., Redmanol Chemical Products Co., and Condensite Co., into the Bakelite Corp., he was elected vice-president and director of Manufacturing; and finally because of his qualities of leadership which prompt his associates to call him "Boss."**

# TANTALIZING TOPPERS

LILY DACHÉ

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## by EVE MAIN

It's no trouble getting along with life in the summertime what with fashion designers continually coming through with wearables that laugh at heat—or at least chuckle behind its back. And comfortable headgear is particularly in rapport with mid-summer attire. That is why plastics have been chosen for wide brims and such on hats for every occasion. Cool as a shady lane, light as a fleecy cloud, these toppers are well nigh irresistible to susceptible shoppers. (1) Touring the country in an open roadster, top down and streamers flying in the breeze—a suggestion implied by this creation with its coquette visor of royal blue transparent cellulose. Long scarf-like streamers of raspberry and royal blue attached to the visor may be wound around the chin, throat, or arms according to the whimsey of the wearer. (2) In town—for lunching, bridging, cocktailing or garden partying, a cartwheel with generous brim of black cellulose. The shallow little crown is black taffeta and a row of white gardenias swing around the front. (3) Another hat for similar occasions has a low round crown of stitched white taffeta and wide cellulose brim of a soft whitish transparency, tipped on one side to show a fresh white flower peeping out, companion to the flower on the crown. Both these hats may be had in black, white and some of the pastels such as soft pink or maize and are most effectively worn with dark sheer frocks or dressy dark suits. (4) On the beach—a black hat with wide black brim of transparent cellulose shades the face and protects sensitive skin that is freckle-minded or easily burned to a crisp with a modicum of sun and ocean breezes. (Hats by Lily Daché and Kantor Hat Co., courtesy du Pont.) To complete the summer picture, bags of quiet chic and fine detail. (5) Squashy bag of natural color calf with shell-like cellulose top or (6) shiny black patent leather topped with white plastic frame, both lovely to look at and delightful to carry. (Bags by Wilder Bag Co., courtesy Celluloid Corp.)

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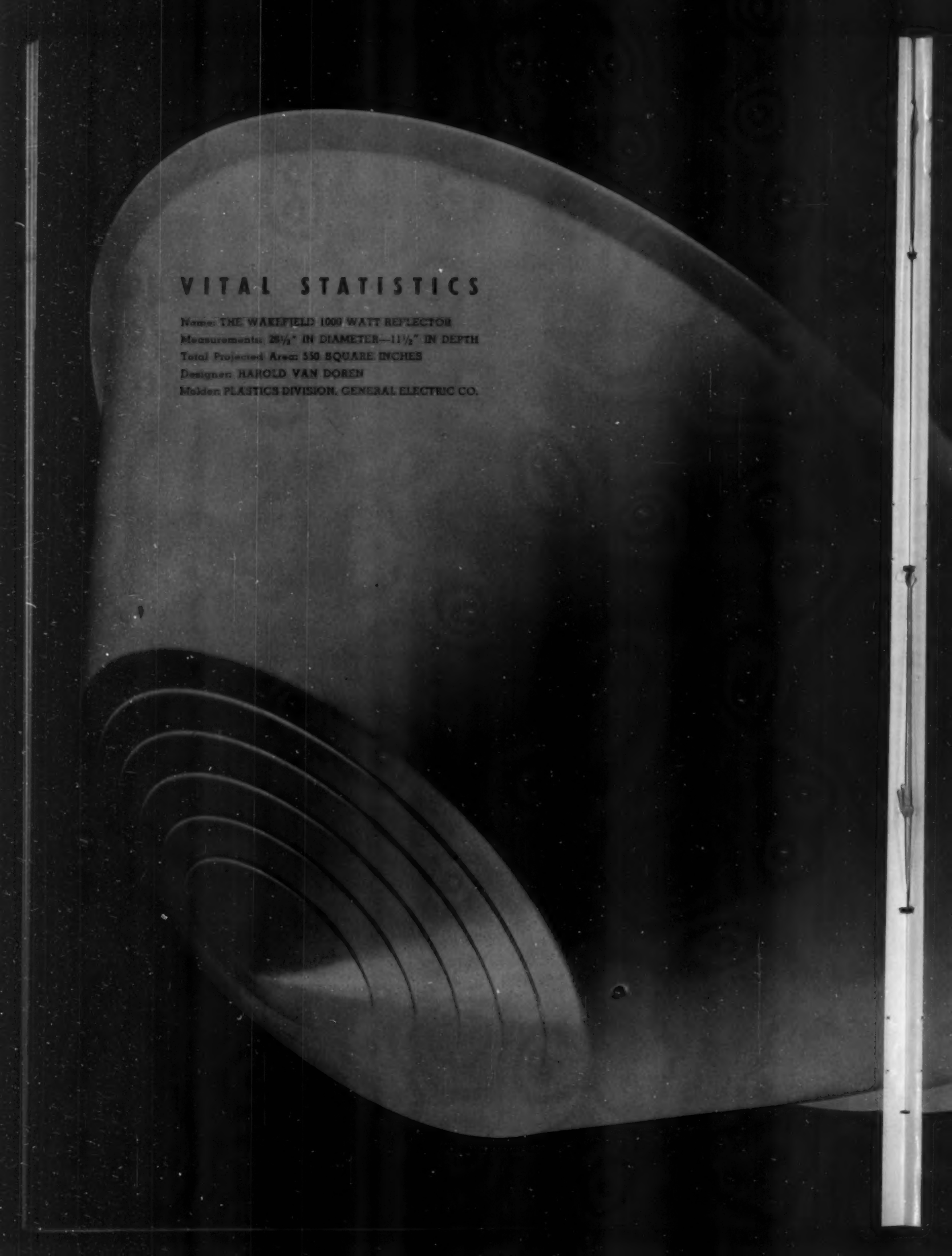
VITAL STATISTICS
Name: THE WAKEFIELD 1000 WATT REFLECTOR
Measurements: 28½" IN DIAMETER—11½" IN DEPTH
Total Projected Area: 550 SQUARE INCHES
Designer: HAROLD VAN DOREN
Molder: PLASTICS DIVISION, GENERAL ELECTRIC CO.

# LARGEST PLASTIC PIECE EVER MOLDED

● The biggest so far! But even more important than knowing the measurements of the largest molding is realizing the profit in Plaskon.

A year ago Wakefield introduced the 300-500 watt Commodore reflector. Acceptance of this Plaskon unit in store, office, and school lighting, has consistently kept demand in excess of the supply. Now Wakefield penetrates this field further . . . for further profit with Plaskon.

Page after page has been written on Plaskon's color . . . on Plaskon's moldability which makes possible moldings as large as the new Wakefield reflector . . on Plaskon's uniformity and permanent finish. And wide mention has been made of Plaskon's light weight which in one year saved $18,000 in freight charges for the Toledo Scale Company. Using Plaskon, capable designers and engineers everywhere are saving money and time for their clients.

But the fact people remember longest about Plaskon is that it sells products faster . . . at a greater profit. When you specify Molded Color, this advantage becomes yours. The experience of Plaskon's engineers and the research of the world's largest producers of urea plastics, also become yours free of charge.

# plaskon

PLASKON COMPANY, INC., 2121 SYLVAN AVENUE, TOLEDO, OHIO

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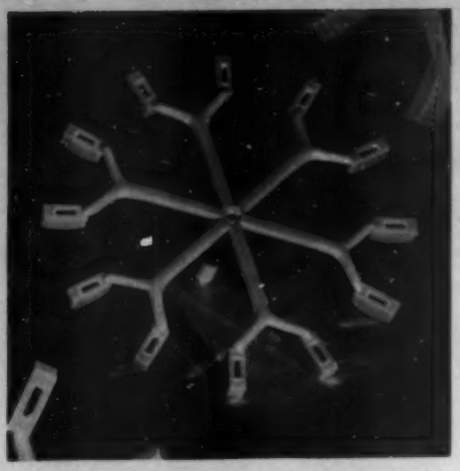

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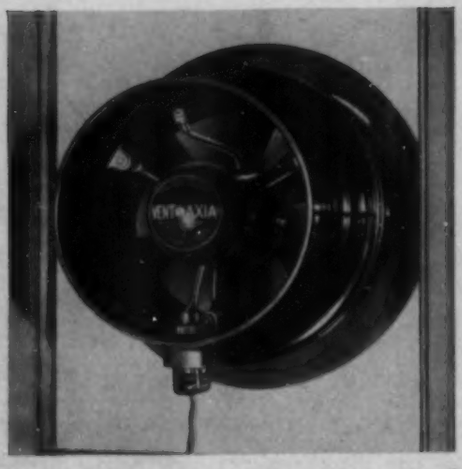

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1. The Lux Clock Company has developed a range timer for Roberts & Mander Stove Company as part of the equipment on its deluxe electric ranges. Molded of Durez it automatically controls the oven and can be used for timing other kitchen operations as well. A pair of matching salt and pepper shakers are available with the timer

•

2. The 1937 Sparton Refrigerator has a molded Durez tray which fits over the deep defroster tray as a cover. It is used for unloading vegetables quickly from crispers, is light weight and resistant to fruit acids, moisture, soap and water. Molded by the Chicago Molded Products Corp.

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3. The pieces gripped in the outstretched tentacles of this injection-molding sprue are tiny Philco radio switches. In one rapid (ten-second) "shot" twelve switches are molded of Tenite and being thermoplastic, all the scrap is re-used

•

4. The new Silex coffee-maker ensemble has incorporated new features of plastics. The serving tray is molded of scarlet Durez with sugar and creamer to match. Table pad, handle and base are also molded in the same bright color

•

5. The Vent Axia ventilator made by Utilities Ltd. is molded of Bakelite as are the rotor and several other mechanical parts. The case of this ventilator is so designed that it acts as a duct to increase the flow of air, but will not allow rain to enter when the fan is stopped. The fan is positioned in a window pane or a circular opening

•

6. Can-O-Lite—a non-mechanical lighter provides a thousand flames. Fuel is packaged in cans which are designed to fit into Bakelite resinoid cases. Striking the metal "match" on the bottom produces an immediate flame. Refilling is accomplished by inserting a new can of fuel and discarding the empty container

•

7. "Pin up lamps" complete with Plaskon base, acetate shades, and molded reflectors are being made by the Atlantic Plastic and Metal Parts Co. for the Railley Corp. Gustave Ameier designed the fixtures taking advantage of the natural finish of the materials on their illimitable range of colors

•

8. This new cocktail shaker called the Ritz is produced by The Monarch Aluminum Company. It is glass lined with a chrome outer casing and the "jigger" cap molded of Bakelite measures out exact proportions for any concoction. The non-clogging strainer of the same material is self-contained and the cover with molded threads assures a liquid-tight seal

•

9. A portable mimeoscope used to reproduce a page of ruled forms or drawings is used by the A. B. Dick Company. The Bakelite frame, 13½ in. wide by 21¼ in. long, is molded by the Richardson Company. The frame has a complicated channel in the back with molded square holes of close tolerances and other fitting attachments

•

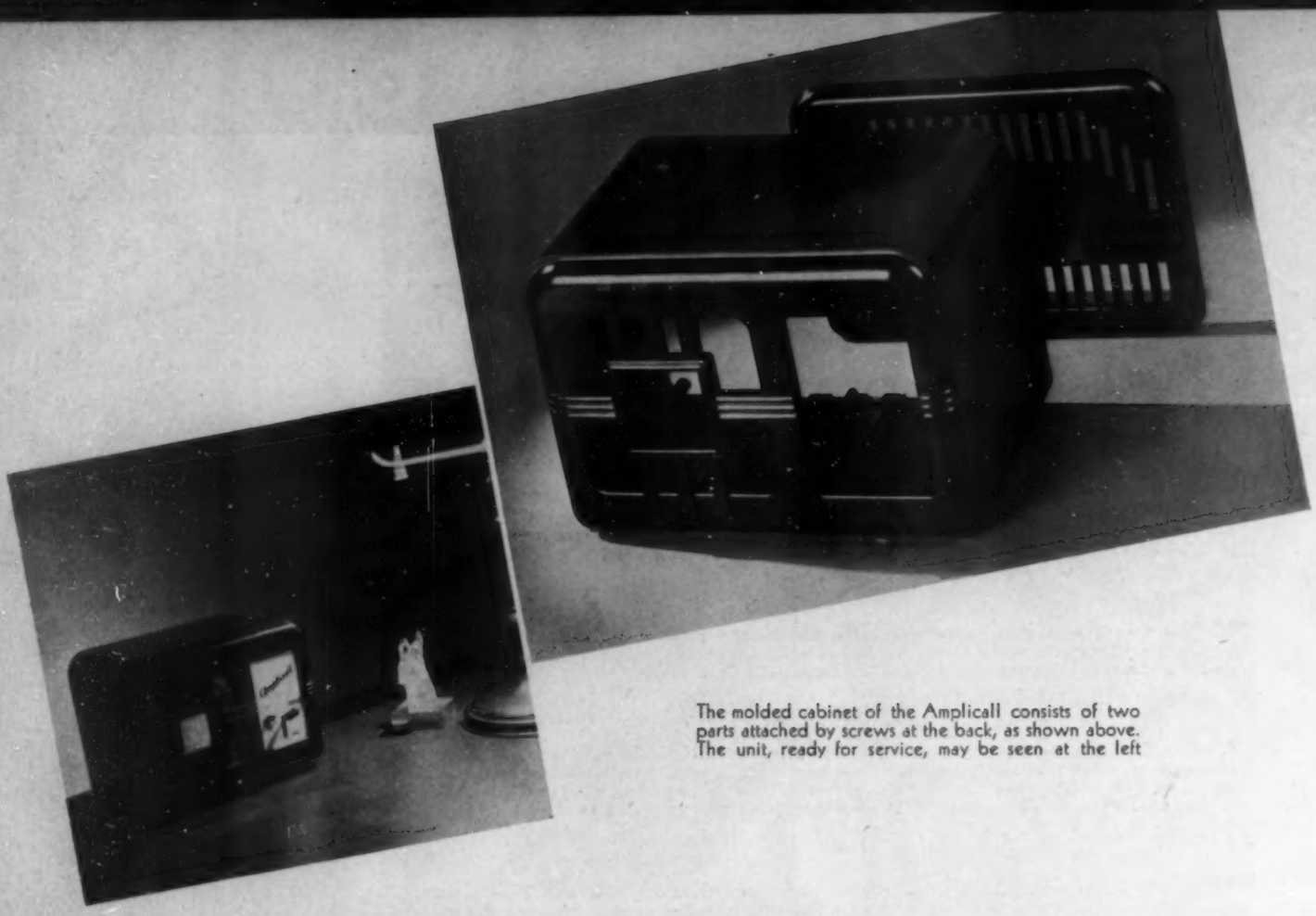
10. The Beacon Dater is the first all-molded dating stamp made in this country. It is molded of Tenite by the Joseph Stokes Rubber Company. The front has a decorative insert—a beacon light—molded in white serving as a contrast, and the stamp is manufactured for the Hill-Independent Mfg. Company. Easy to keep clean, the dater is light weight, and convenient to use

•

11. Bullet Lites are small pocket flash-lights molded of Tenite for Aetna Motor Products Company, by T. F. Butterfield, Inc. They fit the pocket and purse and are quite handy for continual use

•

12. For the 150th anniversary of the signing of the Constitution of the United States, a "Sesqui Centennial Shrine" has been designed to display photostatic copies of the Constitution and Declaration of Independence. John C. Knipp & Sons used Formica to replace marble formerly used for such shrines obtaining an equally decorative effect with much lighter weight



The molded cabinet of the Amplicall consists of two parts attached by screws at the back, as shown above. The unit, ready for service, may be seen at the left

# CONVERSATION IS INEXPENSIVE

**This compact device makes two-way conversation possible at no greater cost than a small radio installation**

THE NEED FOR SIMPLE RAPID INTER-OFFICE communication has long been apparent but until recently the costly equipment necessary to establish such convenience prevented its general use. Such devices were seen most often in the cinema and in executive offices of extensive and wealthy corporations. Now this convenience may be enjoyed by the most humble executive without impairing his capital and is suited to use in the home.

The Webster Company, manufacturers of Sound Equipment, recently introduced an inexpensive inter-office communicating system, called Amplicall, which requires no more elaborate installation than a two-strand telephone wire between the stations to be connected, and an ordinary convenience outlet into which the device is plugged in the same way you would connect your radio.

In fact, the Amplicall resembles a small table-model radio in both appearance and simplicity of operation. It occupies but small space on a desk and when communication is desired, the switch is snapped on, the talking lever depressed, and it is ready to deliver your message in an associate's office. Two-way conversations may be carried on without the necessity of ringing signals, buzzers, or waiting for calls to go through the office telephone switchboard. A tiny light indicates when the Amplicall is in service ready for conversation and when this is snapped off no current is consumed. The current consumed, however, is hardly worth mentioning and the set is not out of service so far as receiving is concerned when the current is turned off.

A volume control with a slotted shaft is mounted on the rear of the chassis which controls the volume of the individual station. Once adjusted to the proper tone, it needs no attention. Conversation is clear and natural.

In introducing Amplicall, the Webster Company chose a molded phenolic cabinet. There were two good reasons for this: First, because such a housing permitted fast economical assembly of the chassis in a material that required no additional insulation; Second, because molded plastics have become so representative of radio and sound equipment that they are quickly accepted and recognized as such. The cabinets are molded of Bakelite and Durez by The Richardson Company.

# Stock molds

## SHEET THIRTY-SEVEN

**These popular knobs and handles are available from stock molds. Kindly use company letterhead when writing to secure samples from the manufacturers who own the molds**

---

**290.** Percolator handle 5 1/2 in. long, 9/16 in. thick; width across top 2 3/8 inches

**291.** Large percolator handle; through-holes for screws at top and bottom; 4 1/2 in. long, 1 7/8 in. wide across top; 9/16 in. thick

**292.** Hexagonal knob each side 5/8 in., 1 in. high; diameter of bottom, 5/8 in., opening 3/16 in. diameter

**293.** Conical-shaped piece, threaded or not as desired; height 1 3/8 in., diameter 3/4 inch

**294.** Rosette knob with a triangular opening 1/4 in. diameter

**295.** Knob with finger grips; height approximately 1 in. Insert 3/16 inch

**296.** Round knob 1 in. high, 3/4 in. across top

**297.** Octagonal knob, each side approximately 1/2 in., 1/2 in. high, diameter of opening 1/4 in., decorated top

**298.** Thumb nut with knurled edges; diameter at opening about 1/8 in., diameter across top about 7/16 inch

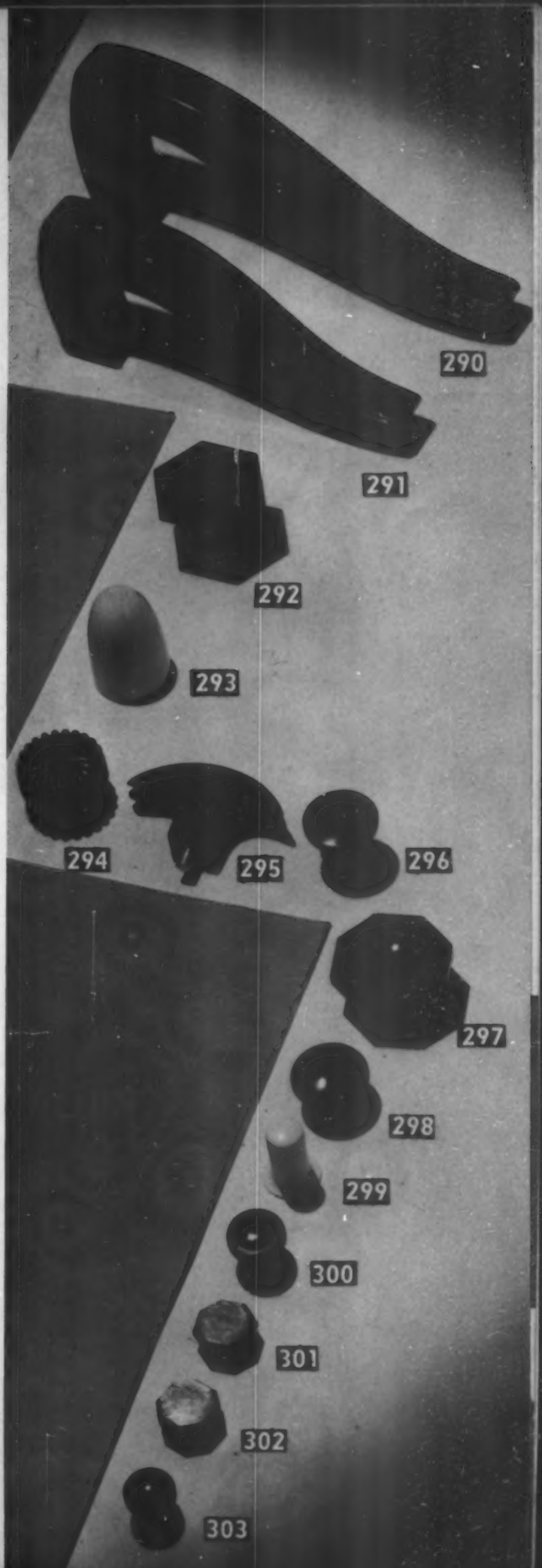
**299.** Shelf knob with threaded insert, approximately 1/16 in. diameter, 3/4 in. high

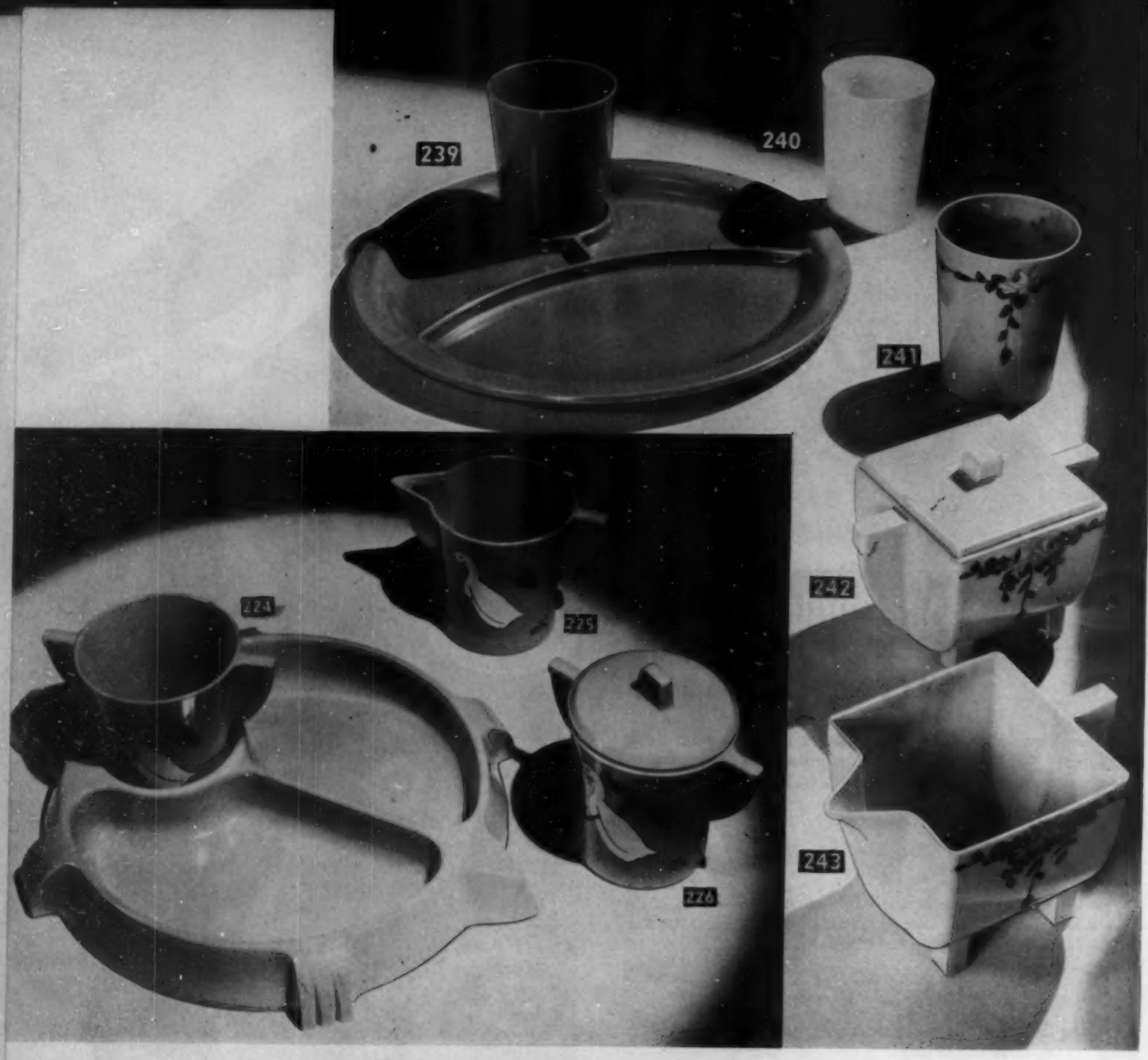
**300.** Thumb nut with knurled edges, threaded opening slightly less than 1/8 in. in diameter, top diameter 1/2 inch

**301, 302.** Hexagonal knobs available with plain or threaded opening 1/8 in. in diameter, 1/2 in. across top.

**303.** Thumb nut with knurled edges; diameter of threaded opening, 1/8 in., diameter across top 7/16 inch

**Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits.**






# Stock molds

## SHEET THIRTY-EIGHT

**Timely premium items available from stock molds in light colors with or without decoration**

**224.** Child's turtle plate in three sections; one for mug and two sections to keep foods separated. Diameter of dish 6 1/2 inches

**225.** Creamer 2 7/16 in. diameter and 2 7/8 in. high

**226.** Sugar bowl or mug with cover. Diameter 2 7/16 in. Overall 3 5/8 inches

**239.** Plate luncheon service. Beaker is 2 3/4 in. in diameter and 3 1/2 in. high. Plate is 8 3/4 in. inside the rim

**240.** Plain beaker 2 7/16 in. diameter and 3 1/2 in. high

**241.** Decorated beaker 2 3/4 in. diameter and 3 1/2 in. high

**242.** Decorated covered sugar 2 3/16 in. by 2 15/16 in. 3 3/8 in. overall height

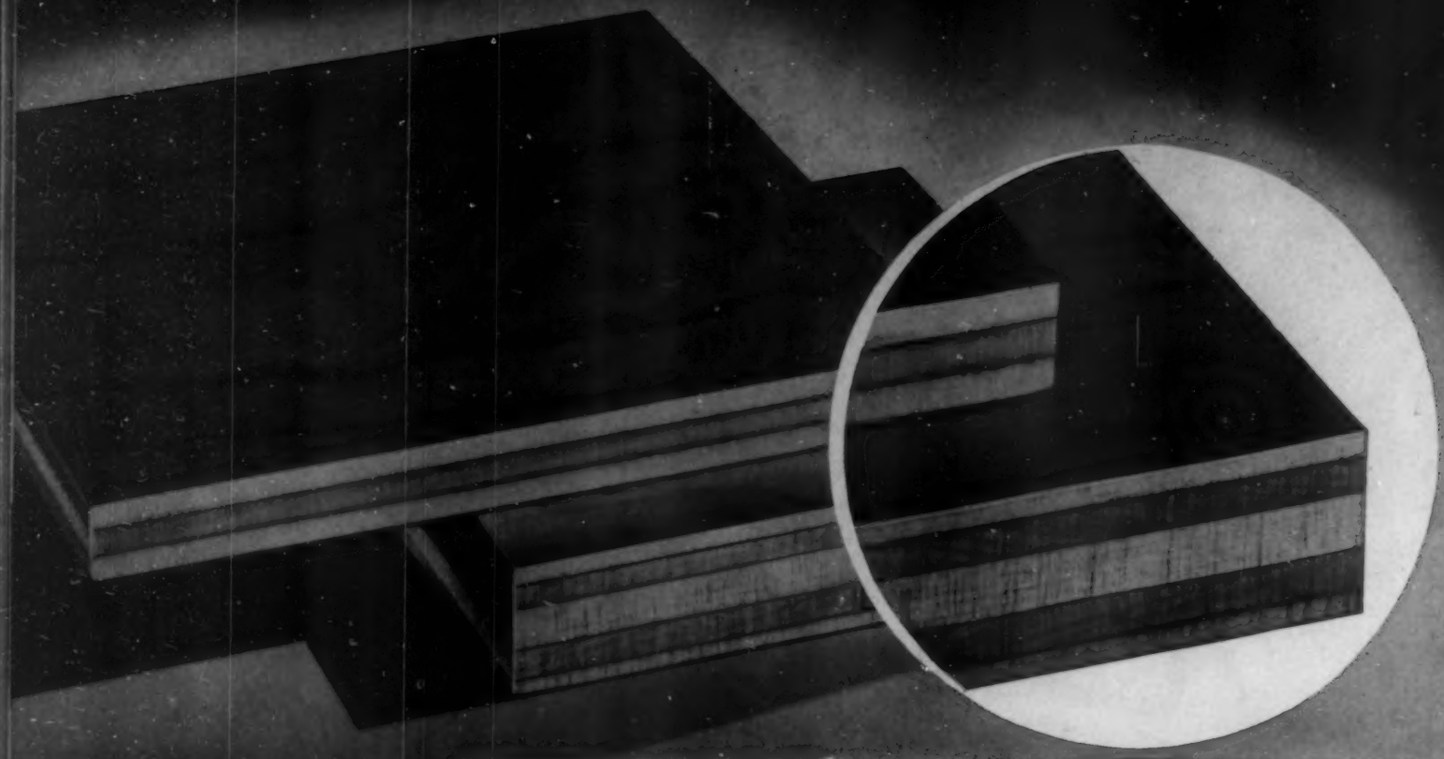
**243.** Creamer to match 242, 3 in. by 2 7/8 in. 2 3/4 in. overall height

**Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits**

MODERN PLASTICS

# TECHNICAL SECTION

STEEL DIE MADE WITH BERYLLIUM COPPER HOB—SEE ARTICLE PAGE 37



# NO. 1020

Durite Special Data Sheets No. 1020 give detailed information about Durite Liquid Resin as a heat-set Plywood Bond and Impregnant for lumber and other porous bodies.

Durite as a Plywood Bond has high bonding strength, is heat and weather resisting, economical. It is antiseptic, proof against decay, fungus, bacterial growth. As an impregnant Durite provides harder, stronger, more weather-resistant products.

A request on your business stationery will bring you Durite Special Data Sheets No. 1020.

**DURITE** *Plastics*

TRADE MARK REG.

Frankford Station P. O., Philadelphia, Pa.

A DIVISION OF STOKES & SMITH COMPANY

*Durite Plastics, the exclusive producers of phenol-furfural resins, manufacture many resins for molded parts, a few of which are shown below. Investigate and* specify *Durite.*

*Durite Impregnated Handle*

# BERYLLIUM-COPPER FOR MOLDS

by L. L. STOTT
The Beryllium Corp. of Pa.

**The physical properties of beryllium-copper alloys with reference to their use in plastic molding**

OVER THE PAST FEW YEARS THERE HAS BEEN a growing industrial interest in the remarkable properties imparted to copper by the addition of small percentages of the element beryllium. Beryllium-copper alloys may well be called a metallurgical triumph, for finally a truly "temperable copper" has been made available for industrial use, a secret popularly reputed to have been lost since the days of the Egyptians.

Whether or not the ancients could actually temper copper by a heat treatment process is debatable. It is certain, however, that they knew nothing of beryllium, as the element has frustrated all efforts to devise a method of commercial extraction from its ores until very recent years. Moreover, its outstanding property of imparting heat treatable characteristics to copper was not discovered until 1926 during a systematic investigation of the element by the firm of Siemens & Halske in Germany.

With an addition of only 2 percent of beryllium it is possible to harden copper by heat treatment, without any cold work, up to 370 Brinell or 42 Rockwell C. Cold worked strip and wire of the alloy can be tempered to tensile strengths of 200,000 pounds per square inch, with an elastic limit of 145,000 pounds per square inch. In other words, the material has properties comparable to an .80 carbon spring steel. The hardness obtained is well beyond that of any other copper alloy, and considerably higher than is found in many forms of steel.

The interest of the plastic molding industry in beryllium-copper alloys has been centered on the use of the material for cast molds. This development, first described in MODERN PLASTICS in November 1935, is being gradually expanded as knowledge of casting technique is improved. Although it is still too early to know how widely cast molds will be used, the possible savings in cost as compared to steel molds, where considerable ornamentation is involved in the finished piece, indicate that beryllium-copper molds should not be ignored. Fig. 2 shows a typical ornamental piece where a cast mold is very much cheaper than machined steel.

There has been considerable doubt in the minds of many molders whether cast beryllium-copper had sufficient strength to stand up under the pressures involved. Experience to date indicates that where the beryllium-copper mold is properly cast and correctly heat treated it will give satisfactory life for good-sized production runs. It must be remembered that, although the hardness of cast and heat treated beryllium-copper is not as high as case hardened steel, the actual compressive strength is higher than found in many hobbed steel molds. Table I gives the physical properties of sand cast and heat treated beryllium-copper containing 2.75

Fig. 1

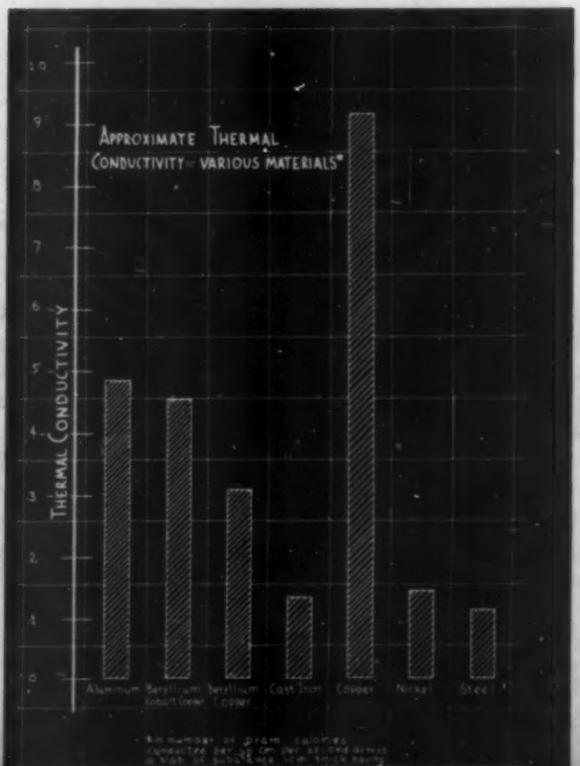
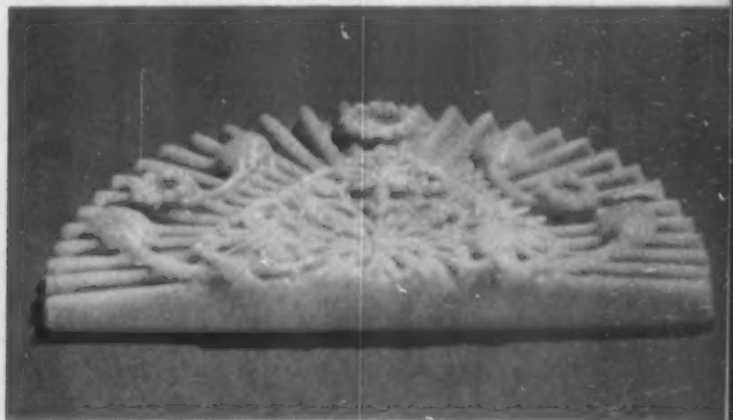



Fig. 2



Beryllium-copper molds are especially practical and economical for repousse moldings with deeply cut designs

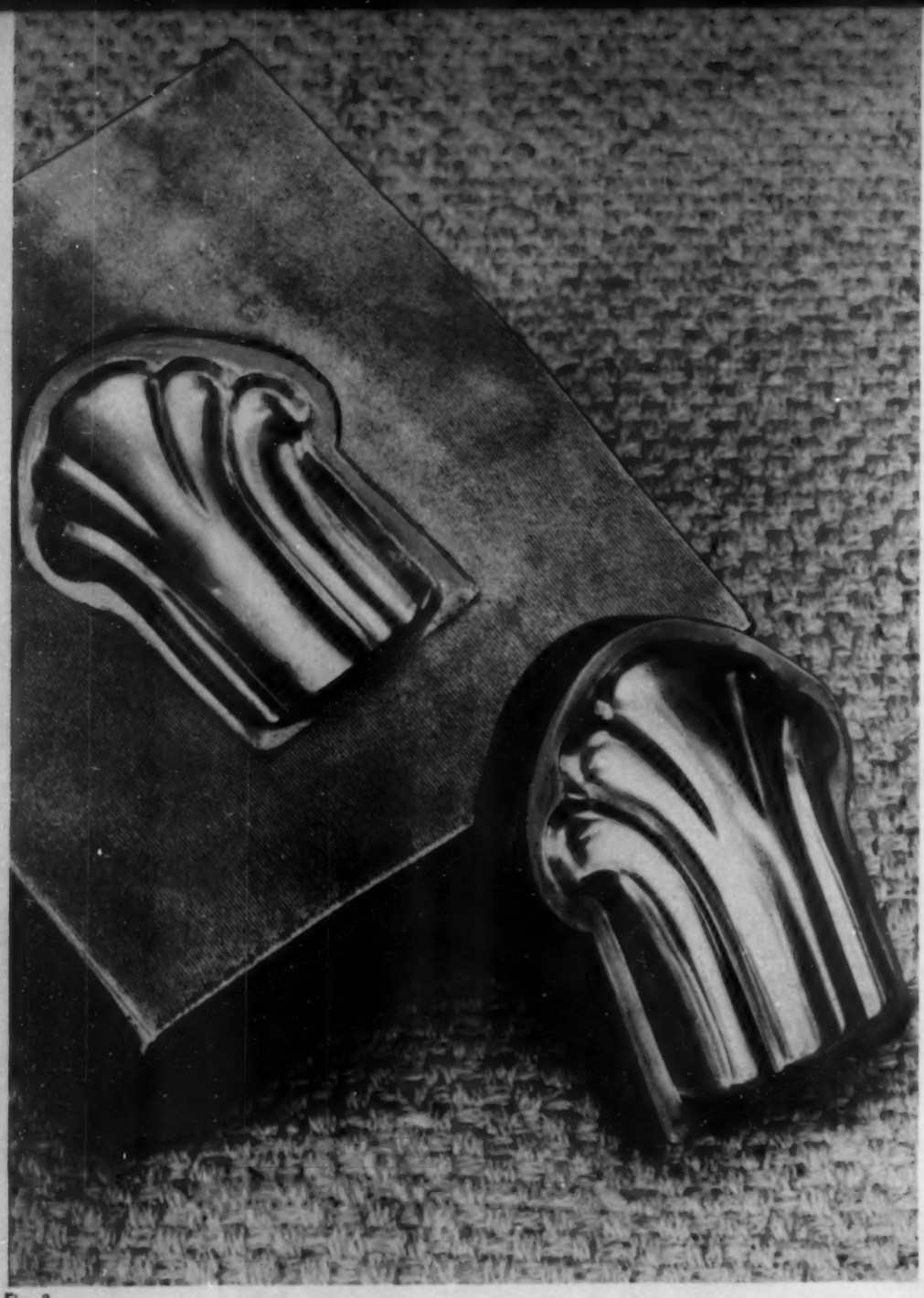


Fig. 3

percent beryllium (see table which appears on page 58).

The amazing strength of this copper alloy can readily be shown by the fact that cast hobs of beryllium-copper can be forced into mold steel without distortion. Fig. 3 shows such a hob, approximately $2^3/_8$ in. by $1^1/_4$ in. in size, which was pushed at 250 tons hydraulic pressure into mild hobbing steel to a depth of $^1/_2$ in. No measurable change in the dimensions of the hob could be detected after this test, although the steel was not relieved in any manner.

It is of interest to note that only six hours of labor were required to finish up this hob, starting with the as-cast surface. As yet sufficient tests have not been made to indicate to what extent hobs of this type can be used, but it is quite apparent that this technique may offer a worth while short cut in making hobbed cavities and mean real savings both in time and in expense.

Although the unusual strength of beryllium-copper is becoming known more generally to engineers, the high thermal conductivity of this alloy has perhaps not been sufficiently realized to date. Fig. 1 gives an interesting comparison of the heat conductivity of various materials. It will be noted that beryllium-copper has a thermal conductivity between two and three times higher than that of steel. This property is of definite interest to the plastic molding industry. As is well known, the production cycle in molding is controlled by the curing time. A certain number of heat units are required to transform a given quantity of molding compound. If these heat units (*Continued on page 57*)

# PRODUCTION AND SALES OF SYNTHETIC ORGANIC CHEMICALS IN THE UNITED STATES, 1936

THE TARIFF COMMISSION HAS COLLECTED AND compiled data on the domestic production and sales of coal-tar chemicals including dyes, and other synthetic organic chemicals for 1936 which we present here in abstract form. Practically all groups of products show substantial gains over the preceding year. In several groups, such as intermediates, dyes, synthetic resins, and miscellaneous non-coal-tar products, the activity in 1936 represents an all-time peak for the industry. Probably the outstanding increase occurred in the production of crude naphthalene, a serious shortage of which caused much concern early in 1936. Output of crude naphthalene increased 88 percent to 89,536,202 pounds as compared with 47,653,372 pounds in 1935.

Among the products of coal-tar origin for which peak production was reported are intermediates, dyes, and resins. Intermediates output totaled 509,705,955 pounds or 16.7 percent more than in 1935. There was an appreciable increase in production of intermediates for synthetic resins, such as phthalic anhydride, 33 percent; phenol, 12 percent; and maleic anhydride about 25 percent. Among the synthetic organic chemicals not of coal-tar origin, many increases in produbtion are noted. The output of this group totaled 2,041,454,244 pounds or 28 percent more than in 1935.

Another gain made by the industry in 1936 was in the production of synthetic resins of coal-tar origin, the total of which was 116,334,635 pounds, with sales of

**Table 2.—Comparison of United States production and sales of dyes and other synthetic organic chemicals, 1925–30, 1935, and 1936**

| | | 1925–30 average | 1935 | 1936 | Increase 1936 over 1935 |
|---|---|---|---|---|---|
| *Coal-tar Chemicals* | | | | | |
| Intermediates: | | | | | |
| Production | Thousands of pounds | 267,492 | 436,656 | 509,706 | 16.7 |
| Sales | Thousands of pounds | 109,133 | 190,917 | 223,119 | 16.9 |
| Sales value | Thousands of dollars | 22,408 | 26,074 | 31,806 | 22.0 |
| Finished coal-tar products:[1] | | | | | |
| Production | Thousands of pounds | 138,078 | [2] 272,728 | [3] 335,091 | 22.9 |
| Sales | Thousands of pounds | 133,964 | [2] 230,381 | [3] 286,033 | 24.1 |
| Sales value | Thousands of dollars | 65,027 | [2] 98,792 | [3] 119,498 | 20.9 |
| Dyes— | | | | | |
| Production | Thousands of pounds | 94,003 | 101,933 | 119,233 | 17.0 |
| Sales | Thousands of pounds | 92,207 | 97,954 | 117,256 | 19.7 |
| Sales value | Thousands of dollars | 39,428 | 51,488 | 62,822 | 22.0 |
| Medicinals— | | | | | |
| Production | Thousands of pounds | 4,508 | 10,023 | 12,034 | 20.0 |
| Sales | Thousands of pounds | 4,106 | 8,950 | 10,079 | 12.6 |
| Sales value | Thousands of dollars | 7,464 | 8,372 | 9,762 | 16.6 |
| Flavors and perfume materials— | | | | | |
| Production | Thousands of pounds | 3,966 | 4,364 | 3,481 | [4] 20.2 |
| Sales | Thousands of pounds | 3,919 | 4,080 | 3,436 | [4] 15.8 |
| Sales value | Thousands of dollars | 2,901 | 3,172 | 3,220 | [4] 1.5 |
| Coal-tar resins— | | | | | |
| Production | Thousands of pounds | [5] 24,442 | [2] 90,913 | [3] 116,334 | 28.0 |
| Sales | Thousands of pounds | [5] 22,135 | [2] 65,923 | [3] 85,286 | 29.3 |
| Sales value | Thousands of dollars | [5] 7,756 | [2] 12,777 | [3] 16,652 | 30.3 |
| *Non-coal-tar Chemicals* | | | | | |
| Production | Thousands of pounds | 379,972 | 1,591,896 | 2,041,454 | 28.2 |
| Sales | Thousands of pounds | 264,006 | 791,760 | 1,034,921 | 30.7 |
| Sales value | Thousands of dollars | 44,499 | 86,334 | 105,831 | 22.6 |

[1] Includes color lakes, rubber chemicals, and miscellaneous coal tar products not shown separately.
[2] Does not include coumarone and indene resins.
[3] Does not include resins derived from coumarone and indene, styrol, hydrocarbons, and sulfonamides.
[4] Decrease.
[5] 1927–30 average.

85,285,926 pounds valued at $16,652,415. The growth of this industry is shown by comparing the 1936 output with the average output for the period 1927–30 of 24,442,000 pounds. Resins derived from tar acids (phenol, cresols, and xylenols) increased in output to 69,382,183 pounds or 30 per cent more than in 1935. Alkyd resin production totaled 46,952,452 pounds or more than 35 percent greater production than in 1935.

Production of non-coal-tar synthetic resins totaled 15,611,041 pounds with sales of 14,766,640 pounds valued at $3,591,467. This group includes resins derived from acrylic acid esters, vinyl acetate and chloride, urea and thiourea, petroleum, and other sources. Commercial production of petroleum resins was reported first in 1936.

**Table 10.—United States production and sales of certain synthetic resins, 1936**

| | Production | Sales | | |
|---|---|---|---|---|
| | Pounds | Pounds | Value | Unit Value |
| | *(A) Of Coal-Tar Origin* | | | |
| Total [1] | 116,334,635 | 85,285,926 | $16,652,415 | $0.20 |
| Derived from: | | | | |
| Phenol | 50,635,448 | 48,125,099 | 9,015,339 | .19 |
| Phenol and cresols | 7,281,897 | 3,690,595 | 1,019,560 | .28 |
| Cresols and xylenols | 11,464,838 | 9,217,697 | 1,305,395 | .14 |
| Phthalic anhydride and maleic anhydride | 46,952,452 | 24,252,535 | 5,312,121 | .22 |
| | *(B) Of Non-Coal-Tar Origin* [2] | | | |
| Total | 15,611,041 | 14,766,640 | 3,591,467 | .24 |

[1] Does not include resins derived from coumarone and indene, styrol, hydrocarbons and sulfonamides.

[2] Includes resins derived from: abalyn-hydrogen-nitrogen, abietic acid, acrylic acid esters, adipic acid, petroleum, terpenes, urea, urea and thiourea, vinyl compounds, and wood-rosin methyl alcohol.

# Cellulose Plastic Products

## NITRO-CELLULOSE AND CELLULOSE ACETATE-SHEETS, RODS AND TUBES

**Monthly statistics on production, shipments, and consumption in reporting company plants of cellulose plastic products (sheets, rods, and tubes) were released today by Acting Director Vergil D. Reed, Bureau of the Census, Department of Commerce. The data were compiled from the reports of 10 manufacturers for January, 1937, and the months of 1936, and January to May, 1935, and of 11 manufacturers for June to December, 1935, and represent practically the entire industry.**

### PRODUCTION, SHIPMENTS, AND CONSUMPTION IN REPORTING COMPANY PLANTS (POUNDS)

| Year and Month | Nitro-Cellulose | | | | | | | Cellulose Acetate | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sheets | | Rods | | Tubes | | Sheets, Rods, and Tubes Consumed in Reporting Company Plants | Sheets, Rods and Tubes | | |
| | Production | Shipments [1] | Production | Shipments [1] | Production | Shipments [1] | | Production | Shipments [1] | Consumed in Reporting Company Plants |
| Total (1935) | 12,528,042 | 11,802,705 | 2,739,259 | 2,822,816 | 938,112 | 800,201 | 3,181,900 | 10,504,003 | 10,117,642 | 227,768 |
| 1936 | | | | | | | | | | |
| January | 966,166 | 993,420 | 208,345 | 208,989 | 55,378 | 49,292 | 229,529 | 869,498 | 934,228 | 24,591 |
| February | 1,071,742 | 887,752 | 179,513 | 204,067 | 70,269 | 56,243 | 218,556 | 596,898 | 545,691 | 26,684 |
| March | 922,034 | 949,336 | 218,971 | 230,837 | 83,062 | 58,487 | 233,482 | 784,852 | 938,609 | 26,909 |
| April | 1,109,169 | 1,056,627 | 224,130 | 206,199 | 55,154 | 56,619 | 249,843 | 1,221,442 | 1,096,612 | 23,846 |
| May | 1,089,241 | 1,049,970 | 198,005 | 187,574 | 57,330 | 50,822 | 235,436 | 980,101 | 920,650 | 20,692 |
| June | 889,770 | 966,767 | 198,226 | 185,206 | 65,580 | 53,752 | 250,363 | 1,061,348 | 849,701 | 17,928 |
| July | 979,434 | 965,488 | 181,222 | 167,423 | 64,126 | 65,281 | 190,743 | 1,001,506 | 745,812 | 8,107 |
| August | 1,189,714 | 1,193,878 | 191,727 | 232,680 | 81,326 | 74,364 | 326,475 | 1,162,230 | 1,468,335 | 15,342 |
| September | 1,391,884 | 1,169,101 | 285,998 | 261,513 | 109,563 | 101,765 | 352,977 | 1,203,820 | 1,027,173 | 9,855 |
| October | 1,345,971 | 1,252,723 | 338,480 | 271,598 | 121,704 | 123,949 | 344,242 | 1,461,782 | 1,315,752 | 18,626 |
| November | 1,210,233 | 1,082,963 | 301,738 | 246,133 | 82,104 | 91,254 | 386,092 | 1,437,526 | 1,312,766 | 24,055 |
| December | 1,054,662 | 1,151,581 | 259,506 | 255,832 | 83,373 | 71,154 | 307,214 | 1,255,494 | 1,111,530 | 12,412 |
| Total (1936) | 13,220,020 | 12,719,606 | 2,785,861 | 2,658,051 | 928,969 | 852,982 | 3,324,952 | 13,036,497 | 12,266,859 | 229,047 |

[1] Includes consumption in reporting company plants.

*Fan housing molded of Tenite by the Carnie-Goudie Manufacturing Company*

# TENITE

. . . molded by the rapid injection process, provides the new Rand windshield defroster with those elements of strength and durability essential to an automobile accessory. Tough and unbreakable, Tenite offers an important safety factor. Smooth, lustrous, richly colored, Tenite supplies a decorative appearance that defies extremes of temperature. A thermoplastic made from Eastman Cellulose Acetate, Tenite is ideally suited to modern industrial design. Write today for a 52-page book describing its properties, uses and molding.

TENITE SALES REPRESENTATIVES: New York: 171 Madison Ave. Chicago: 2264 Builders Bldg. Detroit: 914 Stephenson Bldg. Pacific Coast: Wilson and George Meyer and Company. San Francisco, Federal Reserve Bldg.; Los Angeles, 2461 Hunter St.; Seattle, 710 Belmont Pl.

**TENNESSEE EASTMAN CORPORATION, KINGSPORT, TENN.** **Subsidiary of the Eastman Kodak Company**

# PLASTICS DIGEST

**This digest includes each month the more important articles (wherever published) which are of interest to those who make plastic materials or use them**

## General

NATURAL RESINS AND SHELLAC. A. J. Gibson. Trans. Inst. Plastics Industry *6*, 107–10 (Jan. 1937). A survey of the British position with regard to sources of these materials. The following data regarding world production of organic plastics during 1935 are of interest:

| | | |
|---|---|---|
| Natural resins: | Rosin | 600,000 tons |
| | Manila, Congo copals, etc. | 36,000 " |
| | Shellac and lac | 32,000 " |
| | Dammars | 11,000 " |
| | Kauri resin (Copal) | 4,000 " |
| | Accroides | 1,000 " |
| | Other natural resins | 3,000 " |
| | | 687,000 " |
| Synthetic resins (estimated): | United States | 50,000 tons |
| | Germany | 22,000 " |
| | France | 9,000 " |
| | United Kingdom | 16,000 " |
| | Rest of world | 23,000 " |
| | | 120,000 " |
| Cellulose plastics (estimated): | United States | 15,000 tons |
| | Rest of world | 25,000 " |
| | | 40,000 " |

(For a breakdown of the figures for the United States into various groups see the July 1936 issue of MODERN PLASTICS.)

THE PRODUCTION OF PLASTIC MATERIALS. Henry Barron. India Rubber J. *93*, 339–41 (1937). Review of materials and methods used in the plastics industry.

WHY DO WE USE ARTIFICIAL RESINS? Ewald Fonrobert. Farbe u. Lack *1937*, 5–6, 21–2, 31–3, 41–3, 55–6. Advantages of synthetic resins as compared with natural resins.

THE CELLULOSE ACETATES—THEIR PRODUCTION AND APPLICATION. H. P. Staudinger. Chem. Trade J. *99*, 513–14, 535–6 (1936). The production of cellulose acetate and the properties of sheets, yarns, and lacquers made of it are considered.

## Materials and manufacture

THE VISCOSITY OF ETHYLCELLULOSE. N. Legrain. Rev. Gen. Mat. Plast. *13*, 123–9 (April, 1937). The viscosity can be reduced without affecting the strength or chemical composition of the ethylcellulose. Acids lower the viscosity more rapidly than heating with water or bases. Acids of various types behave differently even though equal concentrations or pH conditions are employed. The mechanism of the specific effect of the acid anions has not been determined.

YELLOWING OF CELLULOSE NITRATE PLASTIC BY LIGHT. P. Trevy. Rev. Gen. Mat. Plast. *13*, 131–3 (April 1937). Traces of metallic impurities, particularly copper or iron, influence unfavorably the resistance of cellulose nitrate plastic to light. These impurities may come from the nitrating acid, the cellulosic raw material, the plant equipment, or the wash water. If proper precautions are taken, the temperature of nitration, bleaching process, plasticizers, and viscosity state of the cellulose are not important factors in light instability.

A NEW SYNTHETIC RESIN PLASTIC MATERIAL. J. F. Kesper. Kunststoffverarb. Folge B, *4*, 3–4 (July–Aug. 1936). Cf. Chem. Abt. *31*, 3169 (1937). A discussion of the physical properties of a new phenolic-wood-flour plastic, the composition of which is not disclosed.

ETHYL ALCOHOL AS A POTENTIAL SOURCE OF PLASTICS. H. Langwell. Chem. and Ind. *56*, 503–6 (May 29, 1937). The availability of petroleum as a source of alcohol and the conversion of the latter into resins of the vinyl, styrene, and methacrylic types are discussed.

IMPROVED PHENOLIC PLASTICS—THEIR PROPERTIES AND USES. Franklin E. Brill. Product Eng. *7*, 462–4 (1936). A review.

RONILLA L, A NEW POLYSTYRENE ARTIFICIAL RESIN. Donitz. Farbe u. Lack *1936*, 633. This resin is stated to be readily soluble in many common solvents, transparent to ultraviolet light, resistant to sunlight and weathering, and characterized by excellent dielectric strength.

MIXED PHENOL-FORMALDEHYDE RUBBER RESINS. F. Klein. Rev. Gen. Mat. Plast. *13*, 57–60 (1937).

## Molds and molding

METAL DIE TECHNIC FOR CURING VULCANITE AND THERMOPLASTICS. C. S. Ballard. J. Am. Dental Assoc. *23*, 2313–23 (1936). Molding of dentures.

## Testing

TESTING OF UREA PLASTICS. W. Blakey. Chem. and Ind. *56*, 177–81 (1937). Methods for the determination of plasticity, bulk factor, moisture content, and various physical, molding and electrical properties are discussed.

## Applications

FORMALDEHYDE: THE KEY CHEMICAL FOR ANTI-CREASE FINISHES. P. H. Anderson. Textile Col. *59*, 311–12 (May 1937). A discussion of synthetic resins for textile finishing, primarily urea-formaldehyde. The effect of formaldehyde on casein and cellulose fibers is also considered.

NEW MATERIALS REDUCE WEIGHT OF VACUUM CLEANER. Anon. Machinery *43*, 615 (May 1937).

PLASTICS. Herbert Chase. Automotive Industries *76*, 722–30, 738 (May 15, 1937). A review with particular reference to automotive uses.

SYNTHETIC RESINS AND THE DYEING OF COTTON. Anon. Textile Col. *59*, 340 (May 1937). The essential features of certain patents relating to the use of synthetic resins to modify the dyeing qualities of textile fabrics and to improve the fastness to washing of various colors are presented.

PLASTIC MATERIALS—THEIR USE IN THE BONDING OF MICA, ETC. Anon. Electrician *118*, 484 (Apr. 9, 1937).

USE OF SYNTHETIC RESINS IN THE PREPARATION OF PERMANENT BACTERIAL MOUNTS. B. F. Skiles and C. E. Georgi. Science *85*, 367–8 (Apr. 9, 1937).

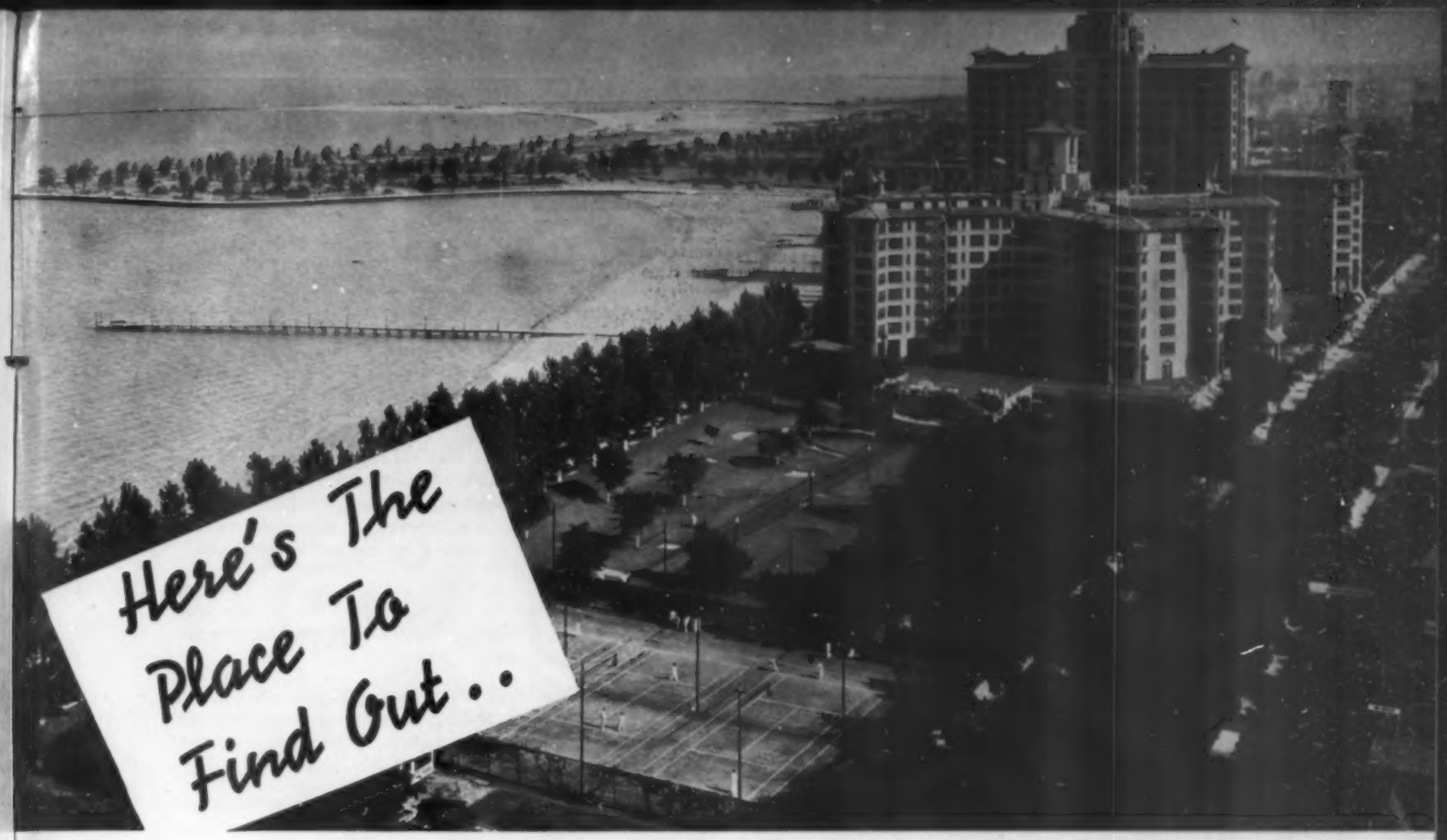
USE OF SYNTHETIC RESINS TO PRODUCE WOOL-LIKE FINISH ON SPUN-RAYON FABRICS. P. LeBrun. Textile World *87*, 944 (Apr. 1937).

## Synthetic coatings

RECENT COMMERCIAL DEVELOPMENTS IN SYNTHETIC RESINS. E. H. Trussell. Paint and Varnish Prod. Mgr. *16*, 18–26 (June 1937). In addition to describing currently available resins of the ester gum, phenolic and alkyd types, this paper discusses urea-formaldehyde resins, new to the protective coating field. The outstanding properties of the films obtained with urea-formaldehyde resin when properly cured in the range of 225° to 375° F. are extremely glass-like hardness, scratch resistance of surface, exceptionally pale color and perfect color retention, lack of thermoplasticity at elevated temperatures, and total insolubility characteristic of the three-stage resins. They are supplied as concentrated solutions in a mixture of butanol and xylene in several grades which vary in hardness, flexibility, and speed of cure.

RAW MATERIALS FOR THE PAINT AND VARNISH INDUSTRY. L. A. Jordan. Chem. and Ind. *56*, 484–8 (May 22, 1937). This is a survey of the British sources of pigments, drying oils, solvents, thinners, and resins used in the paint and varnish industry. Cellulose, phenols, and glycerol are the chief chemical raw materials required for the manufacture of the synthetic film-forming ingredients.

REINFORCEMENT BY PHENOLICS. W. Krumbhaar. Oil and Col. Trades J. *91*, 925–6 (1937). Phenolic resins are evaluated by their reactivity with ester gum, linseed oil, and tung oil, the reactivity usually increasing with the degree of unsaturation of the resin and oil. A satisfactory film is obtained only when the ingredients of a varnish have reacted chemically with each other.




*This advertisement prepared by Commercial Advertising Agency Inc., Chicago*

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How your Advertising Department can do a bigger job will be the principal theme of the 15th Annual NIAA Industrial Advertising and Sales Promotion Conference and Exposition at the Edgewater Beach Hotel, Chicago, September 22 to 24, 1937. There will be talks by nationally known industrial leaders . . . by sales executives . . . and advertising directors. There will be speaking sessions, round table discussions, clinics on numerous specific topics, extensive exhibits of advertising and sales promotion materials, and rare opportunities for person to person exchange of ideas.

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# NIAA

**• • 15TH ANNUAL ADVERTISING AND SALES PROMOTION CONFERENCE AND EXPOSITION**

**SEPTEMBER 22, 23, 24, 1937**

**EDGEWATER BEACH HOTEL, CHICAGO**

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Please send further information about the program of the 1937 Conference and Exposition, sponsored by the National Industrial Advertisers Association

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# U. S. plastics patents

**Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each**

VARNISH RESINS. Israel Rosenblum. U. S. 2,081,153–4, May 25. Reacting a phenol-aldehyde organic salt of zinc resinate with a polyhydric alcohol and an aromatic carboxylic acid to make a resin, or condensing glycerol with phthalic, maleic and boric acids in presence of linoleic acid until the product is soluble in toluene.

MOISTUREPROOF FILMS. G. Schneider (to Celanese Corp. of America). U. S. 2,081,155, May 25. Flexible self-supporting films which are highly impermeable to moisture are made by mixing together two different forms (high viscosity and low viscosity) of the same cellulose derivative and forming the film therefrom.

DECORATIVE LAMINATED SHEET. F. J. Hoarle (to Celluloid Corp.). U. S. 2,081,538, May 25. Decorative effects are obtained by applying a cement to a cellulose derivative base sheet, laying on thin metallic threads and applying a softened surface sheet, then hot pressing the assembly so that the embedded metallic threads give a scintlilating effect.

TERPENE RESIN. E. R. Littman (to Hercules Powder Co.). U. S. 2,081,753, May 25. Making a resin by condensing terpin with maleic anhydride.

PIPE SHIELD. S. P. Miller and L. T. Sutherland; L. T. Sutherland (to Barrett Co.). U. S. 2,082,174–5, June 1. Coating pipe lines with a waterproofing composition, then with a shield of fabric impregnated with a hard, tough resin.

CLEAR CELLULOSE ACETATE. H. L. Barthelemy and E. E. Huffman (to Tubize Chatillon Corp.). U. S. 2,082,238, June 1. Making clear, haze-free cellulose acetate by acetylating pure bleached cellulose having its moisture content carefully controlled (2–6 percent), at reaction temperatures not exceeding 90 deg. C.

HOLLOW ARTICLES. Albert Nadai. U. S. 2,082,715, June 1. Making thin-walled hollow articles from cellulose derivative plastics by shaping the plastic in a mold, then heating the mold while dipping the article in hot oil containing a dissolved plasticizer, and at the same time inflating the hollow article against the mold.

CELLULOSE ETHERS. F. C. Hahn (to E. I. du Pont de Nemours and Co.). U. S. 2,082,797, June 8. Treating alkali cellulose with crotonyl chloride to form a cellulose crotonyl ether which is soluble in alcohol, benzene, acetone and ethyl acetate and which hardens on aging.

CELLULOSE ESTER SALTS. C. J. Malm and C. R. Fordyce (to Eastman Kodak Co.). U. S. 2,082,804, June 8. Making sodium salts of the cellulose esters of dicarboxylic acids, by reaction of the ester with a weakly basic sodium salt under such conditions that hydrolysis is avoided.

LAMINATED FABRIC PRODUCTS. L. T. Sutherland (to Barrett Co.). U. S. 2,082,854, June 8. Impregnating different fabrics (called A fabric and B fabric) with a mixture of a coumarone resin and an oil-soluble heat-hardenable phenolic resin, superimposing alternate layers of the impregnated fabrics and joining them under heat and pressure.

PATENT LEATHER. R. C. Shuey (to Bakelite Corp.). U. S. 2,083,040, June 8. Making durable noncracking patent leather by incorporating a phenol-aldehyde resin in the drying oil coating composition to impart flexibility and elasticity which are retained by the dried coating even upon aging.

RESIN COMPOSITION. N. D. Hanson (to Bakelite Corp.). U. S. 2,093,063, June 8. Blending a heat-hardenable phenol-aldehyde resin with a chlorinated naphthalene by adding a triaryl phosphate to prevent separation of the blended ingredients.

THERMOPLASTIC. J. D. McBurney and E. H. Nollau (to E. I. du Pont de Nemours and Co.). U. S. 2,083,199, June 8. Stiffening collars with a thermoplastic polymerized ester of methacrylic acid serving as an interliner between fabric plies.

HARDENING RESINS. F. I. Bennett, Jr. (to Revolite Corp.). U. S. 2,083,423, June 8. Apparatus for heat-hardening a hardenable synthetic resin coating on fabric by passage through a preheater and an oven.

VULCANIZED OILS. Laszlo Auer and P. Stamberger; Laszlo Auer (to J. Randolph Newman). U. S. 2,083,549–50, June 15. Mixing raw or bodied fatty oils with a sulphurizing agent and vulcanizing in the form of an aqueous emulsion or as a nonaqueous vulcanizable oil composition; in the latter case a current of steam is used to heat the oil.

CELLULOSE ETHERS. L. H. Bock and A. L. Houk (to Röhm and Haas Co.). U. S. 2,083,554 and 2,084,125, June 15. Making ethers of cellulose and partially etherified diglycol alkyl ethers, or of monoglycol amyl (or higher) ethers.

VINYL RESIN PRODUCTS. G. E. Zelger (to Eastman Kodak Co.). U. S. 2,083,628, June 15. Making shaped articles from polyvinyl alcohol by molding from an aqueous solution of polyvinyl alcohol and then condensing the alcohol polymer with formaldehyde.

CARTRIDGE SHELL. P. E. Pihl and S. F. Mashbir (to Washington Institute of Technology). U. S. 2,083,665, June 15. A metal cartridge shell is embedded in a synthetic resin outer shell.

CELLULOSE ESTERS. M. J. Reid (to Eastman Kodak Co.). U. S. 2,083,667, June 15. Recovering cellulose mixed esters, such as the acetate-butyrate or acetate-propionate, from their mixtures with nitrocellulose by extraction with a selective solvent for the mixed ester, e.g., an alkylene chloride.

ABRASIVE ARTICLE. J. N. Kuzmick and J. Kuzmick (to Raybestos-Manhattan, Inc.). U. S. 2,083,719, June 15. A synthetic resin bond for abrasive grains is intimately mixed with lead oxide to toughen and harden the bonding film surrounding the abrasive particles.

HYDROCARBON RESINS. H. I. Waterman (to Shell Development Co.). U. S. 2,083,883, June 15. Making resins by chlorinating a mixture of cyclic unsaturates and naphthenes and condensing the product with similar but not chlorinated hydrocarbons.

MERCAPTAZOLE RESINS. Jan Teppema (to Wingfoot Corp.). U. S. 2,084,011, June 15. Reacting mercaptobenzothiazole with formaldehyde and ammonium sulphide, then resinifying the product by further reaction with formaldehyde.

RUBBER DERIVATIVES. T. C. Morris (to Wingfoot Corp.). U. S. 2,084,042–3, June 15. Making condensation products from rubber by treatment with chlorostannic acid or stannic chloride at a temperature of at least 160 deg. F., as a rubber cement in absence of air or in a current of air rapid enough to equalize the temperature.

NEW PHENOLIC RESIN. E. C. Kneale and H. H. Wohlgemuth U. S. 2,084,203, June 15. Forming a partial phenol-formaldehyde condensate, adding glycerol to prevent further condensation and condensing the product at a higher temperature with rosin.

ABIETIC ACID RESINS. A. L. Osterhof (to Hercules Powder Co.). U. S. 2,084,213, June 15. Condensing an abietic acid ester with formaldehyde in presence of *p*-toluenesulphonic acid.

BORATE RESINS. W. A. Boughton and W. R. Mansfield (to New England Mica Co.). U. S. 2,084,261–2–3, June 15. Making colloidal, waxy or resinous products from boric acid and polyhydric alcohols and using such resinous materials as bonding agents in building up laminated or molded mica products.

# What does it mean TO WIN the MODERN PLASTICS Award?


In an industry growing at so explosive a pace as has the Plastics field, some standard was needed . . . some guide for growth . . . some clearing house for the recognition of outstanding achievement.

And already, in its second year, the Modern Plastics Competition has been recognized throughout the industry as setting that standard, providing that recognition which—as much as the urge to profits—will serve to spur on the entire industry to new developments.

To be selected, from among the hundreds of entries, as one of the twelve winners of awards, in this—the 1937 Competition—will mean to each firm and person who played a part in the creation of the prize winner, the following:

Recognition . . . throughout the plastics industry of work well done, a job thoroughly mastered, a solution soundly obtained.

Recognition . . . in hundreds of the nations newspapers and magazines, in pictures and text . . . as a representative of the best the industry has to offer.

Recognition, for all time to come, in the form of the fittingly molded Modern Plastics Placque of Award . . . a coveted and envied token of achievement.

To all who—as designers, molders, fabricators, sponsors, or machinery manufacturers—have participated in the creation of fine plastic products, Modern Plastics again extends a cordial invitation to enter this competition. Send now for entry blanks.

**FOUR GROUPS:**

1. Industrial . . . for the outstanding industrial achievement in which plastics were a major factor.
2. Scientific . . . for the most ingenious use of plastic materials in the development or promotion of science or scientific apparatus.
3. Style for the smartest adaptation of plastic materials to style merchandise within the form of wearables or accessories.
4. Decoration for the most appropriate application of plastics in architecture, interior decoration or design, furnishings, fixtures, household utensils, etc.

# MODERN PLASTICS

**425 FOURTH AVENUE, NEW YORK**

# NEWS and NOTES

Amber cup and saucer, so transparent that one can read a newspaper through them readily, molded from the new Catalin phenol-formaldehyde molding resin. Design and molds by Hurst Inc.

### Catalin molding powder

After a long period of preliminary exploration, followed by two years of intensive laboratory activity and final testing, the Catalin Corporation announces its successful production of a thermosetting, phenolic resin molding powder, which affords a great vista of possibilities for the designer and user of plastic materials. The new material inherits most of the properties of Catalin cast resins including their beauteous depth and broad range of color, resistance to heat and acids, and uniformity of physical properties. It is about one third the weight of glass by volume.

This new molding compound will be produced in the same broad range of colors which this company introduced into the plastic field with cast resins, varying from water clear crystal through an almost endless spectrum of delicate pastels, brilliant tones and black and white.

The new product is reported to be available in limited quantities in transparent, translucent and opaque material and offers the molder a transparent molding resin in delicate pastels that is odorless, tasteless, heat and acid resistant. This opens up a great new field for the production of colorful items and immediately suggests artfully wrought and beautifully toned table wear such as cups, saucers, plates, platters and drinking vessels as well as a new and elaborate array of buttons, buckles and other decorative items.

"The new Catalin powder," says Mr. Foster of the Catalin Corp., "can be preformed to proper shape and content for molding on standard preforming machines or may be used in its original powder form in any type of compression molding unit now employing other plastic materials. The molds should be preferably of metals which resist staining, such as nickel, stainless steel or chromium plate, where transparent powders are used.

"The molding is done under pressure from 1500 to 3,000 lbs. per sq. in. and at a temperature of from 270 to 300 deg. F. The time in the press varies from three to five minutes, depending upon the type of product being molded. Moldings made from the new powder are as non-brittle as cast resin and may be just as easily drilled or machined after molding should such additional treatment be required."

In the pilot plant operated at the Catalin laboratories cups and saucers from molds provided by Hurst, Inc., were used for testing purposes. These pieces are so clear that a newspaper can be read through them. They were subjected to boiling water, poured directly from a kettle, which they held without the slightest ill effect and without exuding the slightest odor or taste. This, combined with transparency, non-brittleness and broad color range, offers a new high point in the use of plastic molding materials.

In developing its new product the chemists of the Catalin laboratories successfully strove to retain all the fine qualities of all other molding plastics and to eliminate the features which limited their use, practically or economically, to a comparatively narrower range than that required by the industry. The result, the company claims is a brand new product which combines more qualities than any other single type of molding resin heretofore produced.

Catalin molding resin is on a pilot plant production basis during the period in which it is being introduced to the trade. Production will be increased as demand for the new product develops.

### Earl Simonds moves office

J. Earl Simonds, independent consultant on plastics practices has moved to a new office at 13 East 31st Street, New York City. The telephone number, Murray Hill 4-7313, remains the same.

### Westinghouse signs World's Fair contract

Westinghouse Electric and Manufacturing Company has just signed a contract for exhibit space in a building to be constructed by the New York World's Fair 1939, according to Grover Whalen its president. The contract calls for 10,922 square feet of floor space in the Electrical Production Building at the scale price of $152,908. The space is a large part of the total area available in the building, which is to be erected at the southeast side of the Theme Plaza, the heart of the Fair grounds.

### Moldex and Aseptex, new materials

For the preservation of water solutions and emulsions containing vegetable and animal proteins, gums, etc., the Glyco Products Co., Inc., are offering two materials which are of considerable interest.

Under the names of Moldex and Aseptex (Tech.), these two products are recommended for retarding mildew, fermentation, and mold growth in vegetable gums, casein, glue, gelatin, etc., wherever these products are

used for non-edible purposes. Being dry powders, they can be incorporated in the dry products themselves or water, glycerin or alcohol solutions can be made if they are desired.

Both Moldex and Aseptex (Tech.) are finding considerable application in the textile, paper, leather, polish, cosmetic and similar fields.

### Color suggestions for 1937–38 lampshades

The Celluloid Corporation has just produced a sample book showing the different shades of Lumarith Clair de Lune. The pieces clearly marked with color identification are cut in reproduction of actual lampshades and stapled together. Fanned out, it is possible to move the samples around to obtain any desired color combination. Linen and nail head finishes are also included.

There is a twelve-page booklet, too, for the consumer called "Lampshades of Lumarith" written to illustrate the serviceability of Lumarith for lampshade material.

### Changes in du Pont organization

Harold W. Paine has been appointed director of research, succeeding Dr. Allan F. Odell, deceased. Dr. Frederick C. Hahn, leader at the Experimental Station, Wilmington, has been appointed assistant director of research, succeeding Mr. Paine.

### Merservey joins program department of NBC

Douglas W. Merservey will join the program department of the National Broadcasting Company in an executive capacity on July 1, it was announced today by John F. Royal, NBC vice president in charge of programs.

Mr. Merservey, who has been in charge of advertising for the Cellophane division of the du Pont Company, is a graduate of Stanford University and of Harvard Law School. He has been associated with the advertising agencies of McCann-Erickson, Inc., and Erwin, Wasey & Co., Ltd., and has had advertising and theatrical production experience both in this country and in Europe.

### Modern Plastics permanent exhibit

A great many new molded parts have been added to our permanent exhibit recently and we take this opportunity to remind molders and material manufacturers that this exhibit is maintained for their benefit and for the interest of our readers.

We cordially invite all our readers who are in the neighborhood to visit this exhibit any day between 9 A. M. and 4 P. M.

### pH papers

The Lea Mfg. Co., has placed upon the market a new method for the determination of pH by the use of pH papers, which permit visual quantitative determination of the acid or alkaline content of solutions. They are as fast as the well-known Litmus papers and give accurate quantitative results at a glance. Several ranges, as follows, are available: *1, 5.2 to 6.7; 2, 3.6 to 5.0; 3, 3.7 to 5.3; 4, 1.2 to 3.4; 5, 0.9 to 1.5; 6, 9.5 to 11.0; 7, 11.0 to 13.5.* These papers are handy not only in the laboratory but out in the plant where control of acidity or alkalinity in production must be maintained.

### A. I. D. told of synthetics

Dr. James K. Hunt of E. I. du Pont de Nemours & Company, Inc., addressed the annual convention of the American Institute of Decorators at the Waldorf-Astoria Hotel in New York City on Thursday, June 17th, on the subject "New Discoveries in Synthetic Products and Their Relation to Decorating."

Dr. Hunt referred to the present status of the diversified chemical manufacturing industry and discussed the various synthetic products which this industry has to offer the field of interior decoration in the way of new fabrics, finishes, plastics and other materials. Dr. Hunt emphasized the fact that recent developments in the field of synthetic chemistry have made it possible for the decorator to achieve new and beautiful effects, combined with serviceability, which hitherto were impossible with natural products.

He told of the development of finishes based on synthetic resins, including a new enamel for interior woodwork which is actually whiter than white tiling and pointed out how these new synthetic finishes resist the wear and tear of everyday use. Dr. Hunt spoke also of plastics and the increasing use of this class of products in wall paneling, furniture and lighting fixtures.

Pyroxylin coated fabrics which are widely used as upholstery materials, in the making of screens, desk pads, waste paper baskets and other decorative accessories are another class of synthetic materials to which he called attention. In this connection, reference was made to the new waterproof, washable window shades which have found wide application in the home.

Dr. Hunt also referred to water-repellent treatments for fabrics, which modern chemistry has made possible, pointing out that this treatment does not change the appearance of the fabric. One of the newest developments of the chemical laboratory, he said, is a mildew-proofing treatment which prevents the growth of destructive fungi on fabrics that are exposed to dampness.

### General Plastics opens Detroit office

General Plastics, Inc., announce the opening of a Detroit office in the New Center Building, Second Blvd. and Lothrop Ave., Room 518. The office is in charge of J. S. Miller, and a service man will shortly be added to the Detroit staff.

### Banning made chief engineer

Frederick G. Banning, formerly with scientific apparatus department of Cornell University Medical College, has become associated with Designers for Industry, Inc., industrial designers and product stylists, as chief engineer in charge of engineering development.

# BOOKS and BULLETINS

**Booklets reviewed in these columns will be sent without charge to executives who write for them on their company letterheads. Other books will be sent postpaid at the publishers' advertised prices**

### Plastics, new British journal

Temple Press Limited, publishers of a number of business journals in England including *The Motor* and *The Aeroplane*, have launched a new publication called *Plastics* which deals with the manufacture, uses and potentialities of plastic materials. M. D. Curwen is Editor.

The first issue appeared in June with some forty pages of editorial material including the first of a series of descriptive articles titled "What Plastics Are," by H. C. Bryson; "Plastics in Automobile Work" by Maurice Platt, technical editor of *The Motor;* and a department called "Plastiscope" written by G. N. Higgs in which many progressive suggestions are made.

Format is distinctively British. Paper and illustrations are excellent. Two pages of color process in which Catalin and Beetle are featured enliven the book no end. We extend the hand of friendship and welcome to this new publication and wish its sponsors every success.

### Resinox molding book

The Resinox Corporation has just published a booklet which will be of considerable assistance in selecting the grade of Resinox molding compound best suited to each molding job. The properties of the more important compounds are presented and since the booklet is loose-leaf, data on new Resinox products may be added as they are developed. There is also an edition with flexible covers and special binding. An explanation of the methods of testing is given in the "Foreword" and a "Definition of Terms" follows by which it becomes a simple matter to identify the exact compound required for a particular job.

Particle size, apparent density, bulk factor, pourability, preforming characteristics and flow are given on more than thirty standard Resinox molding compounds, as well as specific gravity, flexural strength, dielectric strength, water absorption and shrinkage.

There is a chart showing a summary of properties and their special characteristics with suggested applications together with a summary of properties and characteristics of Resinox colored molding materials. Molding instructions, and shipping regulations are also included.

### Survey of world chemical industry

Chemistry continued the basis of industrial and agricultural progress which was noted in almost every country in 1936 including many of the major and some of the minor chemical-consuming markets as well as the important chemical-producing countries, according to a survey of the chemical industry made available recently by the Commerce Department's Chemical Division.

While a feeling of optimism prevailed almost every-

# BOOKS and BULLETINS

where, hesitancy was noted in some of the chemical-producing countries, particularly with regard to plant expansion and capacity utilization lest the demand be temporary and the result of rearmament programs. As a consequence local industries of some countries were not always prepared to meet expanding demands and imports were resorted to despite the fact that domestic plants were not operating at capacity, the survey reveals.

The devaluation of currencies in the gold-block countries had little effect for the most part on chemical business during 1936 since most contracts had been made far in advance of current needs. Ample supplies, therefore, were readily available at old price levels and prompt Government intervention prevented a too rapid rise in chemical prices in those countries, it was stated.

The financial position of most large concerns improved and dividend payments were either continued or resumed by many of the companies.

No particularly new problems confronted world chemical industries in 1936. The year was characterized more as one of accomplishment during which efforts were made to consolidate old gains and solve problems presented in the two preceding years, according to the study which was made.

All governments displayed particular interest in their domestic chemical industries during the year, many giving aid as well as encouragement in different ways—by establishing control which limited expansions, restricted imports and tightened regulations regarding sales and advertising, particularly in medicinal and toiletry fields, the survey shows.

Chemical research continued on an extensive scale, considerable success was achieved and many new products were introduced to world markets by a number of countries. Chemical processes were developed both with the view to improve or protect health and to attain self-sufficiency in certain lines.

These developments were spread throughout all branches of the chemical industry and in all areas, ranging from a new perfume material obtained from "stink weed" in Australia to a meat "Sofna" in Japan. The survey reveals that Japan probably surpassed all other countries in the number of new products introduced in 1936, the number of chemicals made for the first time in the country and new plant construction and expansion.

In foreign chemical markets, so far as the United States was concerned, competition in 1936 from Japanese and Russian products was not as important as in 1934, except in a few isolated instances, but Germany did succeed in obtaining a larger share of the business in certain areas. To cite specific cases, in the Far East, especially in British Malaya, a feature of the acid and industrial chemical market was reported to be Japanese competition, with prices 40 percent under those quoted by other foreign suppliers; while sizeable shipments of calcium arsenate were received in Peru from Japan. Germany

# BOOKS and BULLETINS

successfully penetrated Central and South American markets, and in Guatamala and Honduras, in particular, its position was much stronger, with appreciable sales of fertilizers and other agricultural chemicals.

The survey, "World Chemical Developments in 1936," known as Trade Promotion Series No. 169, can be obtained from the Superintendent of Public Documents, Government Printing Office, Washington, or from any of the Department's District Offices located in the principal commercial centers of the country at 30 cents a copy.

### Revolite folder

The Zapon Division of the Atlas Powder Company has just issued this interesting folder describing Revolite, which as you may know, is a waterproof, chemical-resistant coated fabric which has been treated with a special Bakelite resinoid. It is finding numerous applications for household accessories and upholstery.

### Wall chart of solvent data available

Carbide and Carbon Chemicals Corporation is offering a helpful wall chart to users of solvents. By consulting this 20 in. by 26 in. tabulation the important properties of 90 commonly used solvents can be quickly compared. On one side is a table of physical properties and on the reverse side are three graphs showing the relative evaporation rates of different solvents which are helpful in formulating lacquers, varnishes, polishes and other industrial products. Use of this chart gives a more accurate idea of solvent utility. It will be a great asset in a laboratory, plant or office. One will be sent to any executive requesting it on his business stationery.

### Brochure issued by Mercoid

Entitled, "Built to Endure," the new 16-page sales brochure, just issued by The Mercoid Corporation, is devoted to a class presentation of Mercoid products. Bound in spiral binding, this book illustrates and describes Mercoid controls that "have grown up with the development of automatic heat." Among the descriptions are those of the Sensatherm thermostat, Pyratherms, line safety controls, limit and low water controls for steam boilers, temperature limit controls, warm air furnace controls, and sealed mercury contact switches.

### Ideal catalog

A revised edition of the catalog of the Ideal Commutator Dresser Company, has been published as a buying reference, and a book of valuable information showing equipment, materials and methods which save money.

A revision was necessary in order to furnish information on many improvements on old products, as well as to include a number of new products and equipment for.

Among the new equipment are a new washer punch, rotary stripper, turning tool head, air gap gage, wire

stripper, and the Ideal Marshall voltage and speed regulator. In addition to a complete listing of its products, the new catalog includes interesting data on electrical and motor maintenance written by expert engineers.

## PUBLIC RELATIONS

*(A talk given by Allan Brown, Advertising Manager of the Bakelite Corp., before the Dotted Line Club of the Associated Business Papers at the Hotel Commodore, Friday, May 14th, 1937.)*

"I was asked to speak for about five minutes on the subject of what the advertiser expects of his agency. If you can imagine someone trying to tell you the history of the world in five minutes, you will realize the problem that I was confronted with. Therefore, I have taken the liberty of changing this subject slightly, but, first, I want to take this opportunity to congratulate the agencies who have received these awards from the Dotted Line Club of the A. B. P. group, for, to me, they are much more than a piece of parchment on which appears a certificate of merit. They really represent the splendid support of the trade press by the leaders in industry, the advertisers, who, with the aid of their advertising agencies have pulled business up by its boot straps out of the mire of depression. By their combined efforts, they have devised ingenious ways of coaxing the consumer's dollar back into circulation, and by their aggressive spirit and their willingness to risk a substantial investment in advertising dollars, they have played an important part in reversing the business trend.

"However, there seems to be one discordant note in this whole picture. During the past few weeks I have had occasion to attend a number of meetings during which the business of advertising was discussed in its various phases. But I could not help but think while listening to these discussions how futile it was to be dwelling at length upon media and methods of advertising and selling when the very foundation upon which business rests is being attacked. You, whose business it is to create advertising can feel justly proud of the splendid job that you have done in promoting the products of industry. You have conceived numerous ways of moving the goods from the factory door to the consumer's larder, but, while you have been engaged in these activities, the business institutions behind these products have been neglected, and in the meantime radical elements, and agitators have poisoned the minds of the citizens of this country against business. They have been led to believe that business men as a whole are a lot of renegades. It is time we came to the defense of business.

"I, therefore, will take the few minutes that are left to present to you an earnest appeal which I sincerely believe to be the most important issue before American business today.

"I think we are well aware of the fact, at least by this time, that there is a world trend toward liberalism. This was confirmed recently by the majority opinions of the Supreme Court, who our Administration has called

from time to time, 'stodgy and unbending reactionaries.'

"The Wagner Act which the Supreme Court recently sustained is in a sense labor's bill of rights. It is up to industry to clarify and protect its bill of rights. And, the issues at stake go far beyond the relations between employer and employee, for they involve such factors as the right of private enterprise, civil rights, property rights, and the right to exercise personal initiative.

"As Channing Pollock recently said: 'Today, we have arrived at a crisis where civilization must be carried on by superior ability, or surrender to superior numbers. We are witnessing one of histories greatest levellings, a vast equalizing of incentives and rewards, the penalizing of those capable of forging ahead, and bringing up from the rear those who are not.'

"It is a simple matter to convict business by exposing a few. It is easy to find here and there a leader who is unscrupulous, wealth that is predatory, employers who are oppressive, and, when this criticism continues unabated, day after day, month after month, year after year, even the most conservative minded citizen begins to believe these things that he is told, although at first they may violate his most treasured convictions.

"Why does this condition exist? What makes it possible for public opinion to become so distorted that millions of citizens can no longer differentiate between the simple economics of running the home and the running of a business or a government? The reason is that these people have heard but one side of the story, for the voice of true business has remained silent.

"The solution to this problem is the interpretation of the facts of business in simple elementary language which can be easily understood. This is a task that cannot be accomplished in a day, in a week, or a month, but we must start now if business is to protect itself in the final court of judgment, the court of public opinion.

"To me, this is a challenge to every advertiser, to every advertising agency, and to the press.

"You, gentlemen, have helped solve many difficult marketing problems in your day, but here is one that transcends all others, and we need all the ingenuity, all the shrewdness, and all the experience that you have at your command.

"The first objective should be a unity of purpose, and every advertising agency and every business paper whose very existence depends upon the life of business can play an important part in this recruiting campaign by impressing upon business the necessity of undertaking a program of employee and public relations immediately.

"What is the meaning of these two terms? By employee relations I refer to the conditions under which an employee works. Such things as, fair hours at fair wages, sanitary working conditions, insurance plans, profit-sharing plans, stock ownership plans, athletic associations, safety campaigns. These are the things that should be done and not talked about. The fact that they are done is part of the employee relations program.

"The other task of public relations is a broader one, and, even more important, for a favorable public opinion is one of the most valuable assets a company can have.

"This involves educating the public. But, this is a trite statement. Just what do we mean by interpreting business to the public. To me, it means giving the public facts to help offset the fallacies which the agitators have implanted in the minds of the masses. For example: You hear a man say, 'I should worry about high taxes. They don't bother me.' We assume the man that makes this statement does not pay an income tax. He overlooks the hidden taxes he pays on the hundreds of products that he buys, such as a quart of milk, and a gallon of gasoline. It's up to business to show the distribution of their income dollar. How much goes to labor? How much to management? How much to taxes? To profit?

"You hear another person say: 'What right has industry to pile up profits when people are hungry? Employers should support everyone without a job. He's the one who lays them off.' The person who makes a statement like this has no conception of the interrelationship of business.

"When the Russians stopped drinking tea, the natives of India who raised it could no longer pay for the goods produced by the cotton mills at Manchester, England. When those mills shut down the cotton wholesalers along the Ohio River failed, and thus it is that the local merchant, and the local doctor can no longer collect his bills. But, someone is bound to rise up and point his finger at Wall Street and blame big business for something that is entirely beyond their control.

"No business is without risk. Your future and my future cannot be assured, nor can a business's future be assured. Technological changes, new inventions, new trends make obsolete old products and processes. These facts must be impressed upon the public by business.

"When business is charged with being oppressive and selfish, there is a natural temptation to match animus with animus, demolishing libels with exposure of their ignorance, but business cannot afford to be defensive or destructive. It needs to combine information with inspiration, and it is here where you gentlemen can render business a real service.

"And so, in conclusion, I appeal to you to accept this message as a challenge, with the hope that you will help bring to industry that leadership which is so sadly lacking at the present moment."

## BERYLLIUM-COPPER FOR MOLDS

(*Continued from page 38*) can be transferred from the mold to the material more quickly, the curing time can be shortened. Where there is both a heating and cooling cycle required, this advantage of higher thermal conductivity should be doubly important.

Several experimental molds of beryllium-copper are being currently run to get definite information on what can be done in speeding up the production cycle. In one case, in molding a lamp shade in an acetate material, preliminary data indicated that the time cycle could be more than cut in half by using a beryllium-copper mold.

It is quite possible that there will be other uses for beryllium-copper alloys in the plastic industry than the

molds alone. There is no reason why the platens or steam plates could not be cast entirely from one of these alloys and advantage taken of the high thermal conductivity. Experiments indicate that it would be feasible to cast the steam lines integral with such parts, thus saving expensive drilling.

For castings of this size where the unit stresses are not as high as in the mold cavities, an alloy such as beryllium-cobalt-copper should be used. From Fig. 1 it will be noted that this material has a thermal conductivity more than four times as high as steel. Table II gives the physical properties of this alloy. The elastic limit and yield point are well beyond those of mild steels. Beryllium-cobalt-copper is more suitable for heavy castings than the 2.75 percent beryllium-copper, as the cost is materially lower. The hardness of the ternary alloy, however, is only about 200 Brinell, whereas castings of binary beryllium-copper can be hardened to very close to 400 Brinell.

The high strength and thermal conductivity of beryllium-copper are already being used to advantage in injection molding equipment for plungers and other parts of the injector assembly. As engineers become more familiar with the unusual properties of these alloys these uses should expand.

TABLE I

PHYSICAL PROPERTIES OF SAND CAST AND HEAT TREATED 2.75% BERYLLIUM-COPPER

| | |
|---|---|
| Ultimate Tensile Strength | 150,000 lbs. per sq. in. |
| Elastic Limit | 135,000 " |
| Ultimate Compressive Strength | 190,000 " |
| Elongation in 2 in. | 1–2 per cent |
| Hardness | 41 Rockwell C |

TABLE II

PHYSICAL PROPERTIES OF SAND CAST AND HEAT TREATED BERYLLIUM-COBALT-COPPER

| (.45 Beryllium 2.6 Cobalt | Balance Copper) |
|---|---|
| Ultimate Tensile Strength | 97,000 lbs. per sq. in. |
| Elastic Limit | 85,000 " |
| Elongation in 2 in. | 7 percent |
| Hardness | 97 Rockwell B |

Beryllium-copper alloys are available in castings, forgings, and hot or cold rolled bars in several different analyses, depending on the properties desired. Strip, sheet, and wire containing 2–2 1/4 percent beryllium have been on the market for several years and are being used principally for springs. The unique capacity of this alloy to be readily formed into intricate shapes in a light temper and then hardened to maximum properties by a simple one-step, low temperature heat treatment is bringing about a rapidly expanding use. The physical properties of beryllium-copper strip as used for springs are given in Table III.

Industry is traditionally slow to adopt new materials. This fact, coupled with new problems involved in

casting and heat treating, has delayed wide recognition of the remarkable properties imparted by small additions of beryllium. The resultant alloy must be carefully handled from the melting furnace through to the finished article. When this is done, unique advantages are obtained which will become increasingly apparent as engineers try out these alloys to meet special problems.

TABLE III

PHYSICAL PROPERTIES OF BERYLLIUM COPPER STRIP

| Condition | Proportional Limit p. s. i. | Yield Point 0.75 % p. s. i. | Tensile Strength p. s. i. | Elongation in 2 inches % | Young's Modulus p. s. i. $\times 10^6$ | Brinell Hardness 10 mm. ball 3000 kg. load |
|---|---|---|---|---|---|---|
| Annealed soft | 8,000 | 31,000 | 70,000 | 45.0 | 18.0 | 110 |
| Heat treated from soft temper | 46,000 | 134,000 | 175,000 | 6.3 | 18.9 | 345 |
| Rolled 4 B. & S. Nos. hard | 39,000 | 105,000 | 118,000 | 4.3 | 17.2 | 220 |
| Heat treated from 4 Nos. hard | 65,000 | 138,000 | 193,000 | 2.0 | 18.5 | 365 |

## INDUSTRIAL SAFETY DEVICES

(*Continued from page 19*) become a part of the molded piece which cannot work loose.

At first it was not easy to gain acceptance for plastic goggles because the materials used were inflammable, and through the use of pyroxylin many accidents occurred. Workers using them were careless with cigarets or brought their goggles into contact with open flame in one way or another. This established a bad impression which lingered in the trade for a long time until it was demonstrated beyond a shadow of doubt that the acetate and phenolic materials from which goggles are now made will not support flame.

Eye cup type goggles are indispensable in steel mills for men working with scraps, grinding and chipping steel, babbitting, steel fabrication, punching or riveting. Maintenance men including millwrights and other mechanics in steel mills wear them for general eye protection. Those who pour steel wear protective clothing usually of asbestos, with ventilated asbestos hoods which are invariably designed with a plastic holder for the lens. Such protection is absolutely necessary since "explosions" and accidents often occur when metal is poured into a mold or crucible that is not entirely dry and such a catastrophe is likely to happen at any time.

(*Continued on next page*)

# CLASSIFIED



In fact, any foreign matter at these points may cause an explosion of the molten metal.

In ship building, these goggles are used in conjunction with respirators where men are using oxygen torch equipment on lead and other coated steel work and the torch generates injurious fumes. One recent improvement on respirators for electric welding operations has been the use of a positive pressure air line welding helmet. This operation is similar to the gas torch operation where heat from the welding medium used upon lead and other coated surfaces generates deadly fumes. In welding helments, a plastic lens holder has proved more satisfactory than the metal lens holder since the plastic, being an insulator, conducts neither heat nor electricity.

The United States Navy requires a large amount of safety equipment. It buys hundreds of thousands of dollars worth each year for use in its ship yards alone. Safety devices have a place here in all general operations—in the fabrication of steel plates, in foundry work, in scouring and cleaning various component parts of the ship, in naval armament plants in the manufacture of guns, in welding, caulking and all such operations. Ship building, as a matter of fact, is one of the general industries to employ every type of industrial safety equipment. In the manufacture of ammunition and chemicals for warfare, protective equipment is of paramount importance to the health of the workers.

Railroad workers engaged in welding joints on a right of way require still another type of protective equipment, for their eyes particularly, because they must avoid not only flying chips but also injurious light rays present in the arc. For this use Willson Products, Inc. has created a combination goggle called the Chip-Weld which cuts out practically all of the infra red rays. The goggles have two sets of lenses, one over the other, both set in a phenolic frame which is hinged. The outer lenses are a dark greenish yellow, glass, which still permits sufficient vision for welding. When the worker has completed a welding operation, it is necessary for him to smooth the weld with a sledge hammer and for this work he needs clearer vision. The man wearing a combination goggle simply flips up the outer dark colored lenses and proceeds with his hammering looking through a heat-treated super-tough clear lens without the necessity of removing the goggles or even his gloves. There are extending knobs at the bottom of the frames which makes it easy to flip up the outer lenses (Fig. 5). Before this combination goggle was introduced, it was not uncommon for the worker to use protective goggles during the welding operation, then remove them entirely during the hammering process exposing his eyes to the damaging action of flying slivers or splinters of steel.

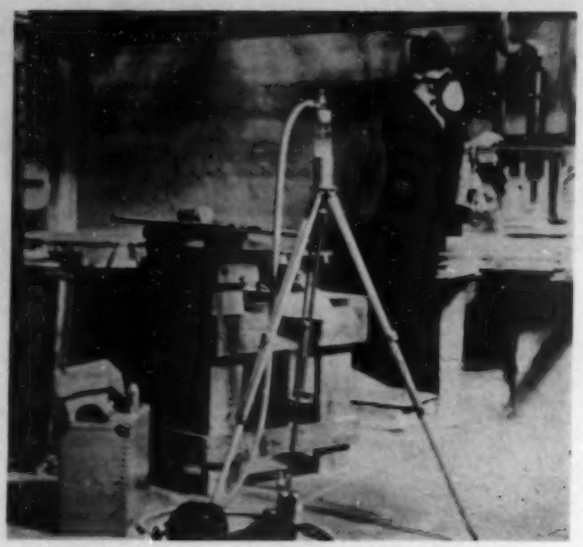
The fiber helmet (indicated as Fig. 2) gives complete head protection in arc welding operations. It is fitted with a double lens much the same as the welding goggles just described except that the lenses are oblong in shape and allow a somewhat wider scope of vision. These lenses are fitted in a special plastic frame designed to resist intense heat and may be flipped up for clear vision during inspection of the weld.

Eye cup-type goggles of transparent acetate protect the worker in this grinding operation yet permit side vision to avoid moving cranes or other traveling mechanism in the plant

A short time ago, "silicosis" became a much used word and a great deal of unfavorable publicity was given to serious complications arising from certain production activities that threatened the health of workers. But too little was said at that time, and since, about available protective equipment which would have prevented much of the sorrow and disaster had it been used. For considerable progress has been made in the past few years, in trying to prevent workers from breathing injurious dust through nose and mouth. Respirators have been produced for practically every occupational hazard and if properly and consistently used will reduce silicosis or eliminate it entirely from industry. Present day respirators for use under certain conditions must comply with specifications approved by the U. S. Bureau of Mines and extensive efforts have been made to compel their use wherever there is an adverse dust condition.

Of course, there are many kinds of dust, some of which are injurious and some which are not, and there must be as many types of respirators as there are kinds of dust. In the granite industry, a silicosis condition is present in every operation from quarrying the stone to putting letters on finished monuments. Both goggles and respirators are imperative for the protection of men engaged in this work. Proper respirators are also necessary in the glass sand industry, mining and manufacturing of silicates, coal mining and in other mines that have a rock condition other than carbonaceous matter. They are equally indispensable in the paint industry where lead ingredients are used, and such respirators range from a simple type to an efficient gas mask type. There are perhaps fifty different types, each designed for a particular dust condition, and some are equipped with chemical cartridges to purify all kinds of fumes.

It is obvious that plastics, both molded and laminated, are favored in the construction of respirators because of their ability to resist corrosion. Where a special acid condition is present in fumes, plastics are more resistant to these fumes than many other materials and their light weight makes a substantially constructed respirator comfortable to wear. The fact that extremely close tolerances can be maintained in the molding operations insures a consistently perfect fit of interchangeable parts,



Using dust collector in factory where bricks are being made of sand. The hydraulic air rammer packs the sand together in a mold and the bricks when removed are baked. The dust gathered is examined in the laboratory to determine its injurious nature

so essential to an air-tight device. Threads, too, are molded into the piece and no matter how many pieces come from the same mold, the threads will always be the same. Inserts and assembly pins are frequently molded in and become integral with the part. Loosening of such inserts cannot occur unless the part becomes broken. Materials may be chosen for the exact service they are required to perform. If for instance, an acid condition is present in the fumes where respirators are to be worn, a phenolic material of high resistance in this condition will be chosen. Furthermore, molded parts are easily cleaned and are unaffected by disinfectants required to maintain sanitation.

The dust situation is a highly technical one and in order to give the greatest coverage and to provide the most efficient protection to workers in its presence, Willson maintains a completely equipped dust laboratory in its plant with a qualified scientist in charge. There are only three such dust laboratories in the United States, but maintenance of one of these at the Willson plant is considered essential to the study and the eventual protection against new dangers which constantly appear. The injurious nature of dust and its presence in a particular industry is gauged by the use of a small instrument called a dust counter. Dust is collected from the air onto a plate under operating conditions in a factory. Examination under a microscope makes it possible to count the number of particles and gauge the amount and type of dust in the vicinity. It is common practice among reputable manufacturers of safety equipment to maintain a force of service or field men who go into industry and recommend the use of proper equipment on hazardous work. They gather dust specimens with an apparatus similar to that illustrated above which are later examined in their laboratory or in an independent testing laboratory before recommendations are made for safety equipment.

Industrial safety equipment has reached a high degree

of efficiency in this country but the movement to protect workmen in hazardous occupations is of international interest and consideration. Large quantities are shipped to South Africa to be used in copper and diamond mines. Safety equipment is compulsory in Mexico as it is in the United States. While not compulsory in South America, its use is expanding, and such equipment is used extensively in England and the Continental countries.

Plastics of American manufacture have found outlets through this market in all sections of the globe. Willson, alone, shipped its safety appliances to 82 countries last year. The use of plastics has not only increased the effectiveness of safety equipment and made it more practical, but its light weight and tactile qualities have made it more acceptable to workmen who are more inclined to use devices which are comfortable to wear.

Most of the plastic parts used by Willson Products Inc. are molded by the Shaw Insulator Company and the American Insulator Company, who are custom molders.

In addition to its safety equipment, Willson Produces Inc. sells each year large quantities of sun glasses with plastic frames.

## MOULAGE AT THE FEDERAL BUREAU

(*Continued from page 23*) undercuts which would ordinarily require two or even three piece molds. The negative mold of glue and gelatin can be pulled and literally stretched away from the undercuts and will spring back into its original shape. Experiments conducted in the Technical Laboratory of the F.B.I. with these materials reveal that considerable heat is required to bring them to the liquid state and they are, therefore, not suitable for making reproductions of animal tissue.

Plaster of Paris, on the other hand, gives a fair reproduction but because it is rigid and possesses none of the elastic qualities of moulage, its use is limited largely to the reproduction of footprints, handprints, and tire tracks, found at the scene of a crime.

A preparation having the advantages of both these materials and which has overcome the difficulties heretofore encountered, was produced by the late Dr. Alphonse Poller, a Viennese, and founder of the Poller moulage method (2) which couples a molding material with agar as a base. Mixed with the agar are such materials as magnesium soaps, absorbent cellulose fibers, and water. (3) The exact formula of this product which is patented and marketed under a trade name, is not published for obvious reasons.

For several years after its first appearance on the market, this material was difficult to obtain in this country. There are now, however, numerous concerns in the United States producing a similar substance which may be purchased at a comparatively reasonable price. Thus, the investigator now has at his disposal a molding material that reaches a liquid state at about 180 to 200 deg. F. and does not commence to congeal until it has cooled to about 108 to 110 deg. F. which is but slightly above body temperature. When applied to the human body it requires about one-half hour for a mold of average thick-



ness (one inch) to set. The setting time may be retarded by thinning the mixture with water, or it may be accelerated by the application of cold towels, or some other cooling method. There is a sufficient amount of resiliency to permit removal of such a mold from objects having an average amount of undercutting. The investigator need have no fear that the material will adhere to the evidence unless it is of a very porus nature when, of course, it would be necessary to grease the material to be reproduced. The introduction of hot positive compositions will not mar the mold unless the temperature is at or above the melting point of the negative moulage. Plaster of Paris may be used for casting without danger of adherence when placed in a negative moulage mold. The negative material may be used repeatedly over a long period of time before losing its strength and elasticity, assuming it has been properly heated and stored. As soon as the cast is taken out, any foreign matter should be removed from the mold. It may then be cut into small pieces, ground in an ordinary meat grinder and stored away in a moistureproof container.

The negative moulage material should be heated in a double boiler to prevent scorching. Lumps should be smoothed out during the heating process and about two hours is generally required to properly heat the material. Having reached a liquid state, it should be allowed to cool gradually. As the outer material cools first, it should be stirred occasionally to prevent the formation of a crust.

In addition to the negative molding material mentioned, Dr. Alphonse Poller also developed a wax-like positive substance with high resin content. The advantages of this positive material which has been simulated by others and is now available in this country, are numerous. For instance, it is possible to brush this material into cracks and crevices of the mold, thereby eliminating the possibility of air bubbles and danger of over-lapping, a condition caused by the junction of hot and cold wax on a smooth surface. Another feature that might be mentioned is that the wax has a sufficiently high melting point to withstand summer heat.

The advantages of moulage for post mortem reconstruction are obvious. Referring back to the hypothetical problem presented in the introduction of this article, which left the investigator faced with the task of identifying a murdered victim, let us consider in greater detail the solution of the problem. Suppose that decomposition had set in and there are ugly wounds about the face and head as is often the case. A photograph of the victim in this condition would not be recognized by acquaintances because of the vast change caused by the disfiguring wounds. A moulage reproduction of the disfigured features may, in many instances, be reconstructed into a life-like representation of the normal features, and by painting the moulage cast to simulate normal living flesh, it is possible to secure a highly realistic replica of the face of the victim.

Take for example the story published in the Chicago Police Journal, May 1934. (4) The author in discussing the reconstruction of facial features that have been

marred by wounds cites the following case: "Interesting also is the manner of identification in the case of Katherina Schaftner-Fellner who was found murdered in the Lainzer Zoological garden in 1928. In order to cover all traces of his crime, the murderer poured benzine over his victim and set it afire. A rain which set in put the fire out, but the parts about the jaw bones were already greatly damaged. The cheeks were badly charred and perfectly stiff. It was not possible to close the mouth. All essential clues for ascertaining the perpetrator of the crime or identifying his victim were lacking. The casting department of the Vienna police took an impression of the upper and lower teeth and made a mask of the face. This mask was kept unchanged as it was taken from the body, but using it as a model another mask was now constructed to illustrate what it was supposed the victim might have looked like in life. A photograph of this second mask showing no scars or wounds was then made. After a year's time, the victim was identified through the cast which had been made of her teeth and through the mask."

It will, therefore, be seen that the moulage method has definite advantages over photographic records of a crime. Even where the features have not been destroyed, moulage is the more successful method of perpetuating the evidence because of the added presence of depth which is, of course, lacking in a photograph. This is not intended to suggest that the photographs be eliminated. On the contrary, it is believed essential that complete photographs be taken wherever possible. However, it is also believed by the F.B.I. to be highly important that photographs be supplemented by tri-dimensional reproductions to the fullest possible extent.

For the benefit of the reader who has not had previous experience in making face masks, the procedure followed in the technical laboratory at the Bureau and abstracted from the F.B.I. Law Enforcement Bulletin, follows:

"In addition to the plastic materials necessary for making these masks, the operator should have at least two strong brushes, about one-half or three-quarters of an inch across the bristles of the brush, a large spatula and a pocket knife for trimming the material as it hardens.

"In getting the subject ready for reproduction of the features, the nasal cavities should be plugged with cotton, care being taken not to distort the contour of the features. The oral cavity also may be plugged or filled with cotton and the mouth closed. A hole is then made in the center of a piece of heavy cardboard and the cardboard adjusted so that the features to be reproduced will show through, cutting off the mask at the hairline just in front of the ears and under the chin. It is not believed necessary, when making death masks, to reproduce the ears because they do not ordinarily serve as a means of identification and when cast as a portion of the total death mask the technique is a little more involved. The cardboard can be held in place by using two-inch adhesive tape, fastening it around the bottom of the mask.

"The first application of the negative material requires the use of the brush. It should be brushed into all the crevices rapidly but carefully so as to smooth out any air

pockets next to the skin. After the features have been uniformly covered with about one-half inch of the material, reinforcements may be added. Strips of gauze saturated with negative moulage or a piece of mesh wire bent to conform with the contour of the mask serve as adequate strengthening media. Additional material is now added until the mold has a uniform thickness of from one to one and a half inches. At no time during the making of the mold should one layer be allowed to set before additional material is added. Otherwise the layers are likely to separate when removing the mold, leaving it greatly impaired. The mold generally requires about thirty minutes to set. Setting may be hastened by the application of cold cloths or by an electric fan. Premature removal of the mold results in a breaking away of the inner portions, thereby ruining the reproduction.

"Before removing the mold, it is advisable to cut away the cardboard so that the operator will have an edge by which to seize the mask with his finger tips. Of course, all negative moulage that has run on to the cardboard should first be separated with a spatula. The mold may now be carefully worked loose around the forehead and gradually around the edges, allowing air to pass under it. Then lift from the forehead and slide downward towards the chin so as to allow the 'undercut' of the chin to free itself. Despite all possible precautions, the operator will often discover defects in the mold. If such defects are convex he should carefully cut them off so as to avoid concave defects in the cast. On the other hand, concave defects in the mold are best left untouched as the resulting convex defects in the cast are more readily corrected than are concavities.

"The cast or reproduction should be made as soon after the completion of the mold as possible, otherwise the mold will dry and shrink thereby contorting the features. The mold should first be placed on a foundation which supports the entire outer surface, which may be accomplished by setting the mold into a box filled with dirt or sand. The operator can then fill the mold about one-third full with positive moulage. With a brush, he then swiftly works the material into all parts of the mold, being certain that the edges of the mold are covered. If the first layer of the positive material, which hardens quite rapidly, thoroughly covers the inside and edges of the mold, the danger of overlapping is avoided. Overlapping is caused by the junction of hot and cold positive moulage which in failing to flow together leaves lines on the finished mask. After a shell about $1/4$ inch thick has been made, paraffin or some other suitable filler can be used to build up the remainder of the cast. The cast when completely hardened can be removed in the same manner that the mold was removed from the face.

"The reconstruction of distorted features caused either by defects or wounds is best accomplished as soon as the cast has been removed. The positive moulage is still in a slightly plastic state and can be more readily worked on than after it has completely hardened. Thereafter the mask can be painted to give it a lifelike appearance."

Beyond its extensive use in the reproduction of death masks, moulage is also used for making dental models

for the identification of unknown dead and for locating missing persons who by chance walk into a dentist's office where the dentist may recognize them by their teeth. Sections of teeth or whole plates can be made of moulage by the same method dentists use in making denture impressions, and positives may then be cast from the mold in plaster of Paris.

Apple cores and pieces of cheese which have been bitten by a supposed criminal and found at the scene of a crime are reproduced in moulage on the theory that a person's bite is as distinctive, or nearly so, as his fingerprints. There are two actual cases on record where criminals have been identified by their bite and convicted through this convincing evidence they carelessly left behind in their hurry to leave.

A police training school in the use of moulage is conducted at the Bureau. The men are competently instructed in handling the material so they will know how to reproduce death masks when occasions arise. These operatives reproduce fingerprints, take casts from their own hands, and reproduce other death masks until they become nearly as accomplished as the laboratory experts. In one instance, a graduate after leaving the school, sent a perfect life mask of himself as a compliment to his instructor. Moulage, as used at the F.B.I., is a commercial product made in America. It may be obtained from a number of art supply, and dental supply houses, or it may be made by a simple formula of easily obtained ingredients.

Perfect reproductions are possible, even to the finest grain in a piece of wood. Firearms are often reproduced at the Bureau, then cast in plaster for display. These, of course, are carefully painted to represent the originals. Otherwise, little attempt is made in the laboratory to trim or decorate the castings made.

This briefly indicates how moulage is used at the Federal Bureau of Investigation, and while the science is still in its infancy, it points to advantages of the process and materials in every possible situation encountered during the course of an investigation. The materials and process, of course, have many additional possibilities outside the field of criminal investigation and have been used for a long time in the fields of Art and Medical Science[3]. Carl Dame Clarke, Department of Art, School of Medicine, University of Maryland, in an article titled "The Technic of Molding and Casting for the Medical Sciences" which appeared in the Journal of Laboratory and Clinical Medicine, Volume 21, No. 1, Page 68, October 1935, details the construction and use of the materials and goes into considerable detail regarding the advantages and disadvantages of various formulas concluding with a description of the formula for both positive and negative moulage which he has found most satisfactory in his own work at the University.

1. F.B.I. Law Enforcement Bulletin, November 1936 issue
2. Dr. Alphonse Poller, "Das Pollersche Verfahren zum Abformen an Lebenden und Tooten Sowie an Gegenstanden"
3. Carl Dame Clarke in his article, "The Technic of Molding and Casting for the Medical Sciences," discusses in detail the practical methods of compounding correct formulas for both the positive and negative moulage materials
4. The Poller Moulage Method, Police 13-13, by E. Febscher

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